Medicine and recreational substance use in pregnancy: epidemiology and the health beliefs of expectant mothers

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PLAGIARISM STATEMENT

I certify that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

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Signature Date

DEDICATION

To my dear husband – Aliyy Olaniyi Wahab – whose promptings and support admittedly launched this PhD programme.

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ABSTRACT

The prenatal use of medicines and recreational substances is of significant importance because there is insufficient information on the effects of medicines and recreational substances on pregnancy outcomes. In addition, literatures on health beliefs of pregnant women about medicine and recreational substance use are lacking.

The aim of this thesis was to investigate medicine and recreational substance use during pregnancy in an antenatal population of London. The study was approved by the ethics committee.

The first part of the thesis was a prospective cohort study of medicine and substance use across all trimesters (using survey methods), and the pregnancy outcomes (using the medical records); the second part was a qualitative study of the health beliefs of pregnant women which employed semi-structured telephone interviews and the Health Belief Model as a framework for data collection and analysis.

The results of the prospective study demonstrated that the prevalence of use of prescription, over-the-counter and complementary and alternative medicines during at least one trimester were 32.5%, 50.2% and 57.1% respectively. The prevalence of exposure to alcohol, cigarette and illicit substances were 16.0%, 3.5% and 0.9% respectively. However, due to limited sample size, the study could not demonstrate an association between the medicines and substances used and increased risk of congenital anomalies in the baby. The qualitative study indicated that pregnant women's adherence to medicines could be explained by women's perception of the

severity of a medical condition, risks of non-adherence to the medicine as well as anxiety about the risks of the medicine on the foetus. In the case of substance use, a low risk perception could be used to explain women's behaviour.

Healthcare professionals have a responsibility to counsel pregnant women about the benefits or risks of medicines and substances, informed by the best evidence, and guided by the women's perceptions.

OVERVIEW OF THE THESIS CHAPTERS

Medicine and recreational substance use in the antenatal period presents a special interest due to the paucity of information on the safety of these agents in pregnancy. In addition, women's perceptions or beliefs about the risks or benefits of exposure have implications on their subsequent health-related behaviour.

This thesis presents the research conducted to investigate medicine and recreational substance use in pregnancy and is reported in five chapters.

Chapter 1 provides a general introduction to the research field, describing the physiologic and pharmacokinetic changes in pregnancy and presents a literature review on the epidemiology of medicine and recreational substance use in pregnancy.

Chapter 2 describes the prospective cohort study which was carried out in an antenatal population of London to estimate the prevalence of medicine and recreational substance use during pregnancy as well as examine the pregnancy outcomes and safety knowledge of the mothers.

Chapter 3 presents another literature review on the health beliefs, attitudes and knowledge of expectant mothers regarding medicine and recreational substance use during pregnancy.

Chapter 4 focuses on a semi-structured qualitative study of the health beliefs of pregnant women.

The last chapter (chapter 5) provides a discussion of the main findings in the thesis, implications of the findings, and identifies areas for further work. It ends with the main conclusions of the research.

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CHAPTER 1 - GENERAL INTRODUCTION AND LITERATURE REVIEW

1.1 General Introduction

The use of medicines and recreational substances during pregnancy calls for special attention because in addition to the mother, the health and life of her unborn child is also at stake. For many years, the general opinion was that the placenta served as a barrier that protects the foetus from harmful agents. However, the thalidomide catastrophe in the 1960s, with the birth of several thousands of severely malformed babies clearly showed that medicines used by the mother can cross the placenta and may have untoward effects on the foetus (Irl and Hasford, 2000; Sanz et al., 2001; Baggley, 2004). The consequence of the thalidomide disaster was an increased awareness of the potential for medicines or substances to cause congenital malformations and other developmental disorders and the necessity to investigate this (Irl and Hasford, 2000). Furthermore, the changes in maternal physiology which occur normally during pregnancy have far-reaching implications on medicine or recreational substance disposition in the woman's body.

1.1.1 The physiology of pregnancy

The process of pregnancy begins when a sperm penetrates an ovum. This is called fertilisation and usually takes place in the woman's fallopian tube. Between 5-7 days after fertilisation, the fertilised ovum implants into the wall of the uterus and starts forming the placenta. The placenta maintains and nourishes the baby by enabling the transfer of oxygen, carbon dioxide, amino acids, fats, vitamins and minerals from the mother's blood. It also allows transfer of waste substances from the growing foetus to maternal circulation. From the time of implantation into the wall of uterus until approximately eighth week of life, the baby is known as embryo. Development is rapid

during this stage as the specialized cells begin to form the vital organs, nervous system, bones, muscles and blood. After the eighth week of pregnancy, the developing baby is called a foetus (Sachdeva et al., 2009).

The trimester of pregnancy is often very important. Some medicines can be dangerous to take in the first three months but safe in the second or third, or vice versa. It is even suggested that women who are likely to conceive should withdraw all unnecessary medicines 3-6 months before conception (Sorensan et al., 2004). The first trimester is the period of greatest risk for the baby. This is because during this stage, the baby's organs are developing. Certain medicines taken early in pregnancy (15-21 days after fertilisation)- during the period of blastogenesis- may act in all or nothing fashion; killing the embryo or not affecting it at all. During this early stage, the developing baby is highly resistant to birth defects. However, it becomes vulnerable to birth defects between the 3rd and 8th week after fertilisation; which is the period of organogenesis. All major organs start developing during this period and medicines or recreational substances reaching the foetus at this stage may cause a miscarriage, an obvious birth defect, or a permanent but subtle defect that is noticed later in life (Porter, 2004). During the second trimester, recreational substances e.g. alcohol and tobacco, can interfere with the development of the baby's nervous system, or with the growth of the baby, resulting in a low birth weight. Development during this time is primarily maturation and growth. Exposure to medicines or recreational substances during this period is believed not to be associated with major congenital malformations but they may alter the growth and function of normally formed organs and tissues (Porter, 2004). Some

medicines or recreational substances taken in the final three months of pregnancy may cause complications for the baby after birth. For example, maternal intake of ibuprofen in the third trimester increases the risk of premature closure of the ductus arteriosus, which may lead to persistent pulmonary hypertension in the newborn (Glover et al., 2003). Medicines taken by the mother can also indirectly affect the baby by interfering with the environment within the uterus. Some medicines, for example pseudoephedrine, can alter the function of the placenta usually by constricting blood vessels and reducing the blood supply of oxygen and nutrients from the mother to the baby. Furthermore, they can cause the muscles of the uterus to contract forcefully, thereby injuring the foetus. Other medicines or recreational substances may cause early, delayed or even prolonged labour, all of which pose a threat to the baby (Briggs et al., 2008).

1.1.2 Pharmacokinetics in pregnancy

The physiologic changes of pregnancy affect the pharmacokinetics of medicines or recreational substances used by pregnant women. During pregnancy, a woman's plasma volume increases by 30-50% and cardiac output and glomerular filtration rate also increase in similar proportion. These factors contribute to lower circulating concentration of some medicines (especially those excreted by the kidneys) in a pregnant woman and possibly to sub-therapeutic medicine levels. Also there is increase in body fat during pregnancy which increases the volume of distribution of fat-soluble medicines. A decrease in plasma albumin concentration during pregnancy increases the volume of distribution for highly protein bound medicines or recreational substances. But the unbound medicines or substances are

excreted out more rapidly by the kidney and liver; and this offsets the effect of increased volume of distribution. Due to the effect of progesterone on smooth muscle activity, gastric emptying time is prolonged particularly in the third trimester thus delaying the onset of effect of some medicines (Frederiksen, 2001; Yankowitz and Niebyl, 2001).

Intramuscular absorption of medicines is generally more rapid due to increased blood flow; which enhances the rate of onset of action of medicines (Yankowitz and Niebyl, 2001). Lastly, oestrogen and progesterone alter hepatic enzyme activity and this can increase the accumulation or decrease elimination of some medicines or recreational substances (Frederiksen, 2001; Hansen and Yankowitz, 2002).

1.1.3 Placental transfer of medicines and recreational substances

The placenta is the functional unit between foetal blood and maternal blood. The functions of the placenta include nutrition, respiration, metabolism, excretion and endocrine activity to maintain foetal and maternal well-being. In order for a medicine or recreational substance to cause a teratogenic or pharmacological effect on the foetus, it must cross from maternal circulation to foetal circulation through the placenta by diffusion (Sorensan et al., 2004). The rate of transfer depends on the chemical properties of the medicine or recreational substance such as protein binding, pH difference, lipid solubility and molecular weight (Kraemer, 1997). Only free unbound medicine or substance crosses the placenta. During pregnancy, maternal plasma albumin decreases while foetal albumin increases. As a result, the concentration of free medicine or recreational substance increases which crosses the placenta to reach the foetus. Foetal pH is slightly more acidic

than maternal pH and so weak bases are more likely to cross the placenta (Loebstein et al., 1997). Moderately lipid soluble medicines or recreational substances can easily diffuse across the placental membrane. Medicines or recreational substances with low molecular weight (< 500 g/mol) diffuse freely across the placenta, those with moderate molecular weights (between 500-1000 g/mol) cross the placenta less easily, while a few others with high molecular weights (> 1000 g/mol) do not usually cross the placental membrane (Kraemer, 1997). Transplacental transfer of a medicine or recreational substance increases in the third trimester due to increased maternal and placental blood flow, decreased thickness and increased surface area of the placenta (Yankowitz and Niebyl, 2001).

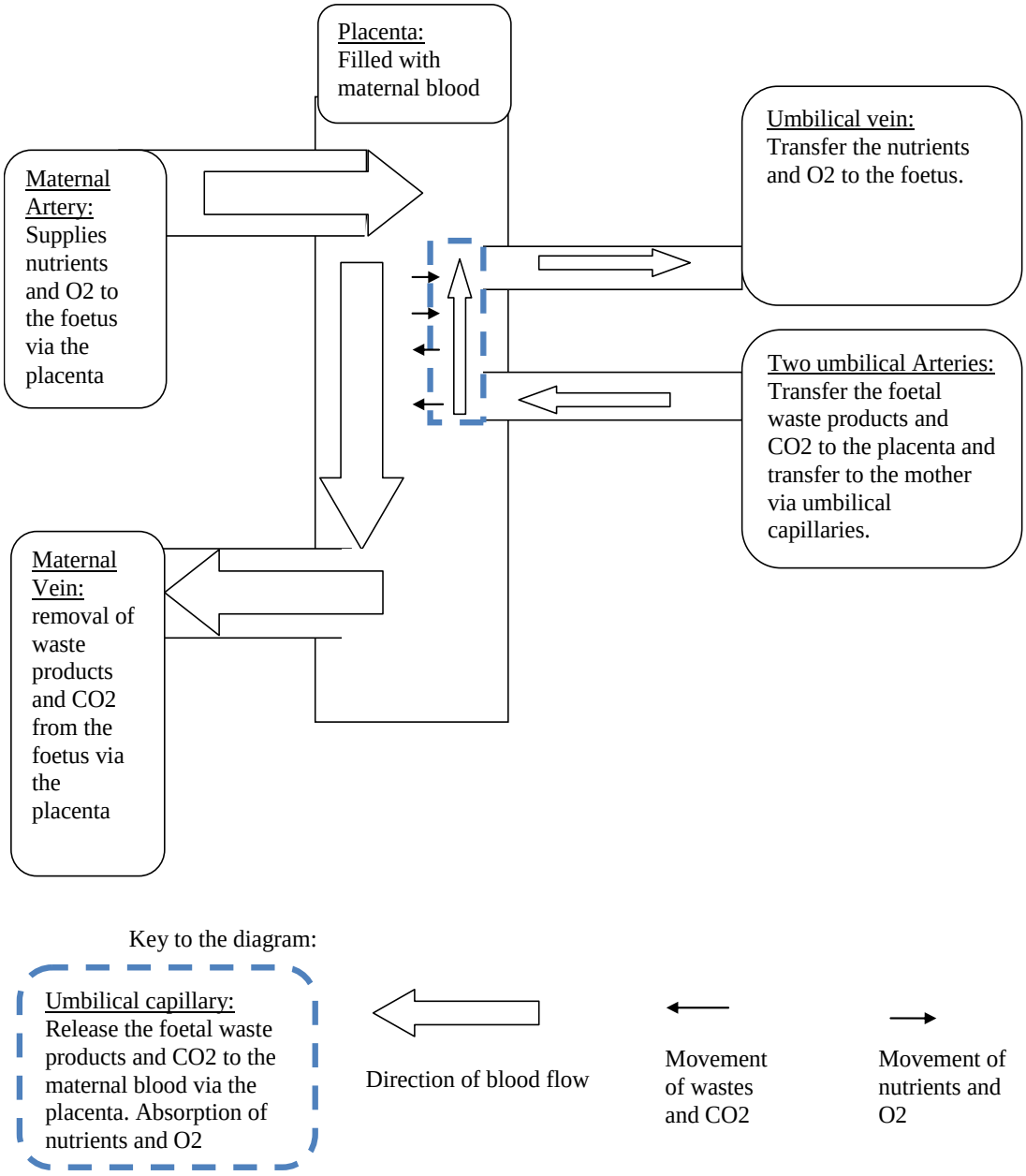

Figure 1 Simplified diagrammatic representation of circulatory systems between placenta, mother and foetus

1.1.4 Medicine and recreational substance use in pregnancy – An overview of risks and benefits

Medicine and recreational substance use during pregnancy has potential risks that may threaten both foetal and maternal health (Koren et al., 1998; De Santis et al., 2004; Lagoy et al., 2005). However, many pregnant women take prescription medicines or are exposed to other agents that may have adverse effects on foetus such as over-the-counter medicines, complementary and alternative medicines as well as recreational substances (Shehata and Nelson-Piercy, 2001; Conover, 2003; Andrade et al., 2004; Schempf, 2007).

Nonetheless, pregnant women can have health problems that require the use of pharmacologic agents, hence prescription medicine exposure in pregnancy is inevitable. When this need is combined with the many physiologic changes of pregnancy, prescribers must make critical decisions regarding the risks of teratogenicity versus the well-being of the mother (Hansen et al., 2002; Vickers and Brackley, 2002; Suresh and Radfar, 2004; Weiner et al., 2005). Although some medicines, such as thalidomide, isotretinoin and diethylstilbestrol have clearly been shown to be teratogenic, data about foetal effects of most medicines is unsatisfactory (Mehta and Larson, 2011).

Exposure to over-the-counter medicines is frequent in pregnant women (Black and Hill, 2003; Conover, 2003; Tillet et al., 2003; Das et al., 2006). Limited information exists on the effects of many of these agents during pregnancy; it is not safe to assume that because these products are

available without medical prescription that they are without danger to the pregnant woman and her foetus (Conover, 2003; Tillet et al., 2003).

Prenatal use of complementary and alternative medicine (CAM) is an area where more research is especially needed. This is because very little is known about the potential adverse effects of herbals in widespread use as dietary supplements or natural health products in industrialised societies. Moreover, the use of CAM to support health in pregnancy is on the increase worldwide (Westfall, 2001; Dugoua, 2010). Some researchers posit that this rise in the popularity of CAM is related to increased ethnic influences resulting from migration and globalisation (Coulter and Willis, 2004). CAM is defined as a group of diverse medical and health care systems, practices, and products that are not generally considered part of conventional medicine. These practices are often grouped into the broad categories below (some practices may fit into more than one category).

1. Natural Products such as herbal medicines or botanicals many of which are sold over the counter as dietary supplements;
2. Mind-Body Medicine such as meditation, yoga, acupuncture, deep-breathing exercises, guided imagery, hypnotherapy, progressive relaxation, qi gong and tai chi;
3. Manipulative and Body-based Practices such as spinal manipulation and massage therapy;
4. Other CAM practices e.g. movement therapies, use of energy fields and whole medical systems (such as ayurvedic medicine, traditional Chinese medicine, homeopathy and naturopathy). (National Centre for Complementary and Alternative Medicine, 2013)

Recreational substances can be grouped into Licit and Illicit substances. The licit substances are alcohol and tobacco while the illicit include cocaine, marijuana, opioids and non-medical use of barbiturates and other tranquilizers. Although the maternal and neonatal consequences of tobacco and alcohol exposure are well established, the evidence related to prenatal illicit substance use is less consistent, necessitating the need for further research in this area (Schempf, 2007).

1.1.5 Summary

Pregnancy is usually viewed in the context of a woman and her unborn baby's overall health. The physiological changes in pregnancy, beginning from the first trimester affects the disposition of medicines and recreational substances in the mother's body. Medicine and recreational substance use during this period therefore presents a special interest due to the paucity of information on the safety of these agents in pregnancy.

1.2 The epidemiology of medicine and recreational substance use in pregnancy – A narrative literature review

1.2.1 Background

Epidemiology is the study of the distribution and determinants of health-related states or events (including diseases), and the application of this study to the control of diseases and other health problems. Various methods can be used to carry out epidemiological investigations: surveillance and descriptive studies can be used to study distribution while analytical studies are used to study determinants (World Health Organisation, 2011).

Pregnancy is a time of particular vulnerability and it is concerning that despite the dearth of information on the safety of medicines in pregnancy, the available statistics indicate that the use of medicines in pregnancy is widespread (Das et al., 2006; Briggs et al., 2008; Davis, 2010). Many pregnant women are exposed to prescription or over-the-counter medicines which are used to treat chronic and pregnancy-induced conditions, such as hypertension, nausea and vomiting, heartburn and backache, which can start afresh during pregnancy or can be exacerbated by pregnancy (Davis, 2010). Furthermore, some medications like vitamins and minerals are essential for the health of the pregnant woman and the foetus. It has been discovered that folic acid administration prevents neural tube defects in the developing baby, leading to the conclusion that the deficiency of this vitamin may be teratogenic (Nelson and Forfar, 1971).

However, ethical concerns about possible harm generally have led to the appropriate exclusion of pregnant women from premarketing clinical trials of medicine safety and efficacy (Koren et al., 1998; Mitchell, 2000; Ward, 2001; Black and Hill, 2003; Webster and Freeman, 2003; Hardy et al., 2006; Gagne et al., 2008). In the post-marketing setting, case series and small cohorts of exposed pregnant women such as the pregnancy registries for newly marketed medicines, can only detect major human teratogens such as thalidomide or isotretinoin. Fortunately, while major teratogens appear to be few, less serious teratogens may be more numerous and more widely used and could therefore lead to a greater number of birth defects than major teratogens (Mitchell, 2003). It is also important to recognise that patterns of medicine use in pregnancy change over time, for some reasons: new

prescription medicines are continually introduced, older ones are increasingly available over-the-counter and concerns may change regarding their safety (Hernandez-Diaz, 2006).

In contrast to prescription and over-the-counter medicines, herbal products and other complementary medicines are usually marketed without the benefit of clinical trials to demonstrate their safety. Thus, safety concerns related to the use of these therapies have emerged (Broussard, 2010). The remarkably limited knowledge regarding the effects of these therapies on the developing foetus requires that special attention should be focused on the study of their risks and relative safety in pregnancy (Broussard, 2010).

Prenatal use of alcohol, tobacco, or illicit substances is also common. Alcohol exposure during pregnancy is a well-recognised public health problem and is one of the few modifiable risk factors for poor pregnancy and child outcomes (Burd, 2003; Peadon, 2010). Even before conception, the toxic effects of alcohol may harm both the ovum and the sperm (Coles, 1994). Maternal factors such as smoking, which is often associated with alcohol use, may also increase the teratogenic effects of alcohol (Young, 1997). The evidence related to the outcomes of prenatal illicit substance use is not consistent and this underscores the need for further research in this area (Schempf, 2007).

In the light of the above, it is critical that the prevalence and adverse effects of medicine and recreational substance use in pregnancy be evaluated and the information made accessible to women and healthcare providers. Knowledge of such data could help to strengthen supposed correlations

between a specific agent and the occurrence of a specific malformation. Therefore, current and coherent epidemiological studies that ascertain the medicines and recreational substances most commonly used in pregnancy are important for establishing priorities in birth defects research with major clinical and public health implications (Gagne et al., 2008).

1.2.2 Aim

To conduct a narrative literature review on the epidemiology of medicine and recreational substance (licit and illicit) use in pregnancy.

1.2.3 Objectives

1. To investigate the prevalence of medicine and recreational substance use during in pregnancy.
2. To determine the medicines and recreational substances reportedly used in pregnancy and adverse pregnancy outcomes.

1.2.4 Methods

1.2.4.1 Literature Search

Three databases – PubMed, EMBASE and International Pharmaceutical Abstracts – were searched for articles which focus on the subject of interest in December 2010 and these yielded 101 articles. The search was then updated in August 2013 with 4 databases – PubMed (1950 to August 2013), EMBASE (1980 to 2013 Week 31), International Pharmaceutical Abstracts (1970 to August 2013), and CINAHL Plus (1937 to August 2013). In addition, reference lists of the relevant articles were searched for other relevant publications.

1.2.4.2 Search strategy and terms

Drug OR Drugs OR Medicine OR Medicines OR Medication OR Medications

AND

Pregnant OR Pregnancy OR Pregnant woman OR Pregnant women OR Gestation OR Gestational OR Prenatal OR Antenatal OR Maternal

AND

Epidemiology OR Survey OR Interview OR Questionnaire OR Database OR Record

1.2.4.3 Inclusion criteria

Articles included were the cohort and cross-sectional studies that were written in English language and focus on the use of medicines and recreational substances in pregnancy. The medicines and recreational substances of interest in this review are prescription medicines, over-the-counter medicines, complementary and alternative medicines and recreational substances (licit and illicit substances).

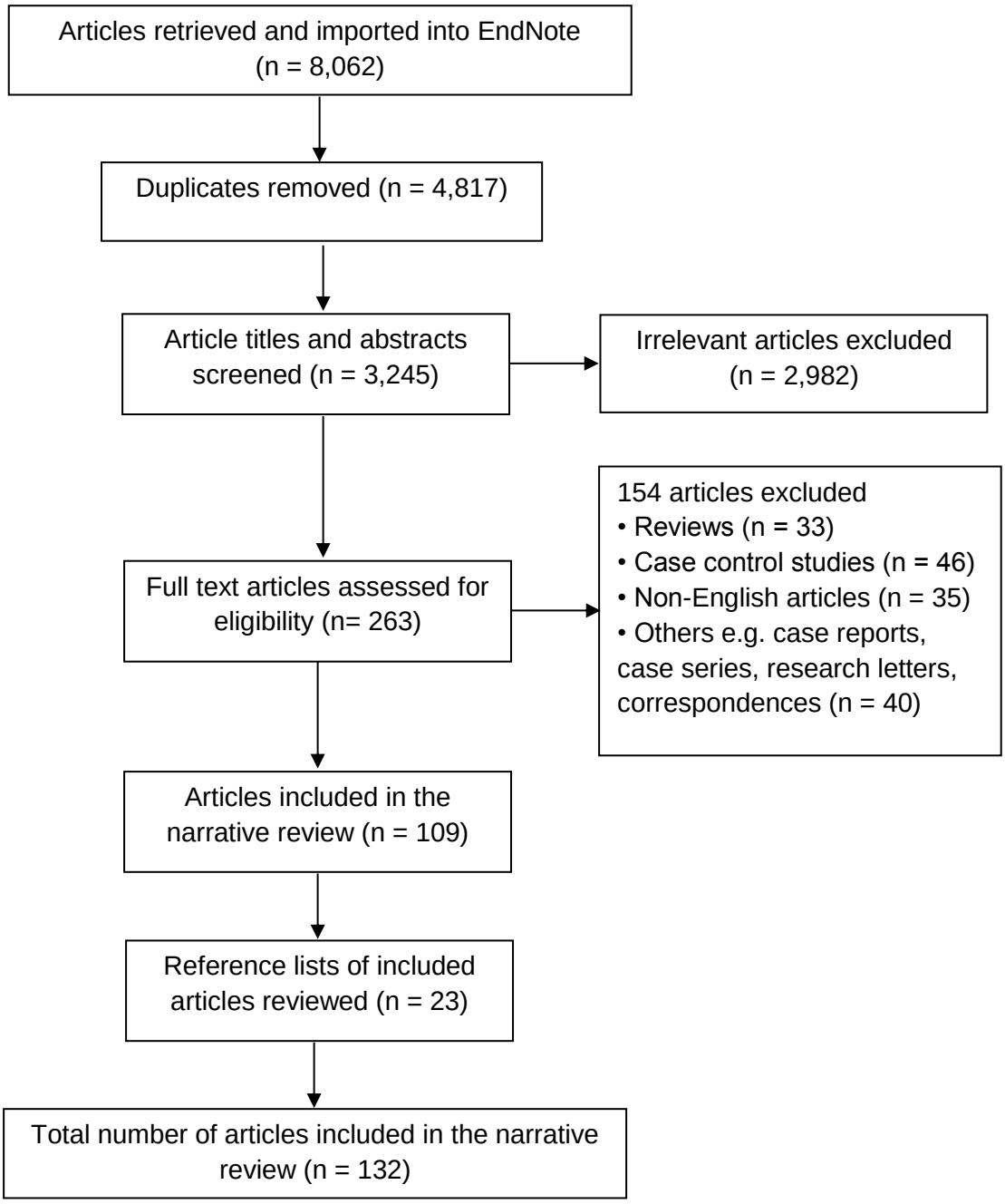

Figure 2 Narrative review flow chart

1.2.5 Results

The electronic search produced 8062 articles – 3687 from PubMed, 21 from EMBASE, 39 from International Pharmaceutical Abstracts and 4315 from CINAHL Plus. The PubMed search was limited to TITLE/ABSTRACT because a large number of articles were obtained without activating the limit. As shown in the narrative review flow chart (Figure 2), 132 studies which were carried out between 1973 and 2013 were included in the narrative review. The summary of the main findings are presented in Table 1 while Figure 3 illustrates the trend in the number of published studies within that time frame.

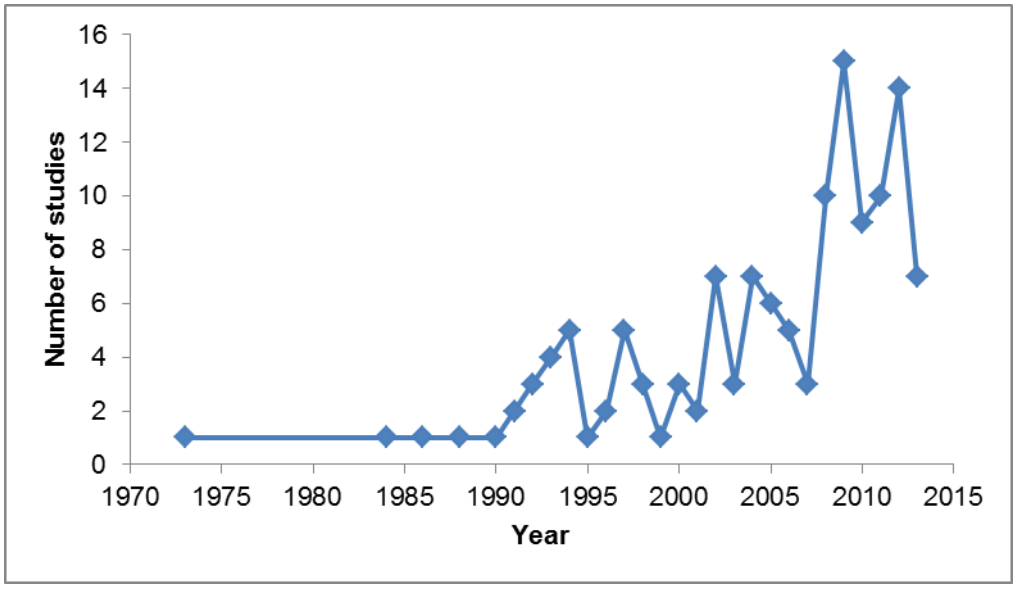

Figure 3 Trend in the number of published studies between 1973 and 2013

Table 1 Articles included in the narrative literature review

Author	*Year of study*	*Country*	*Objectives of the study*	*Methods*		*Population characteristics*		*Type of medicine or substance studied*	*Prevalence of use*				
				Study design	*Data collection*	*Sample size*	*Study participants*		*Prescription medicines*	*Over-the-counter medications*	*Recreational drugs or substances*	*Complementary & alternative medicines*	*Overall*
Forfar and Nelson	1973	United Kingdom	Investigate the drugs taken by pregnant women and those that may affect the fetus adversely	Cross-sectional	Structured interview and medical record review	*n* = 911	Postpartum women (shortly after delivery)	Prescription medications; Recreational drug- cigarette	82%	N/A	57%	N/A	N/A
Golden et al	1984	United States of America	Determine the extent of phencyclidine use during pregnancy	Prospective cohort study	Interview with questionnaire and urine analysis	*n* = 2327	Pregnant women (1st, 2nd and 3rd trimesters)	Recreational drug- phencyclidine	N/A	N/A	0.80%	N/A	0.80%
Rubin et al	1986	United Kingdom	Investigate the use of therapeutic drugs, alcohol and cigarettes during pregnancy	Prospective cohort study	Self-administered questionnaire	*n* = 2765	Pregnant women (1st, 2nd and 3rd trimesters)	Therapeutic drugs, alcohol and cigarettes	N/A	N/A	N/A	N/A	34.80%
Frank et al	1988	United States of America	Assess cocaine use during pregnancy	Prospective cohort study	Interview, urine toxicology and medical record review	*n* = 679	Pregnant women	Recreational drug- cocaine	N/A	N/A	17%	N/A	17%
Chasnoff et al	1990	United States of America	Estimate the prevalence of substance abuse by pregnant women	Cross-sectional	Urine toxicology and medical record review	*n* = 715	Pregnant women	Recreational drugs- alcohol, cannabis, cocaine and opiates	N/A	N/A	14.80%	N/A	14.80%
Buitendijk and Bracken	1991	United States of America	Assess medication use in a population of pregnant women	Cross-sectional	Interview	*n* = 4186	Pregnant women (1st trimester)	Prescription and over-the-counter medications	27.30%	54.90%	N/A	N/A	66%
Correy et al	1991	Australia	Investigate the use of prescription drugs in the first trimester and congenital malformations	Prospective cohort study	Medical form (filled by doctors)	*n* = 56 037	Pregnant women (1st trimester)	Prescription medicines	30.90%	N/A	N/A	N/A	30.90%
C.G.D.U.P. (Collaborative Group on Drug Use in Pregnancy)	1992	Italy	Assess the pattern of drug use in pregnancy	Cross-sectional	Interview using structured questionnaire	*n* = 14 778	Postpartum women (within 1st week of delivery)	Prescription and over-the-counter medications	N/A	N/A	N/A	N/A	86%
Kokotailo et al	1992	United States of America	Determine the prevalence and associated risk factors of cigarette, alcohol and other drug use among school-age pregnant adolescents	Prospective cohort study	Self-administered questionnaire, urine and breathe sample analyses and medical record review	*n* = 212	Pregnant adolescents	Cigarette, Alcohol and Other drugs (marijuana, heroin, cocaine, cannabis, opiates, benzodiazepines and prescription pain killers)	N/A	N/A	17%	N/A	17%

Table 1 Articles included in the narrative literature review (continued)

Ostrea et al	1992	United States of America	Determine the prevalence and epidemiologic characteristics of drug use in a high-risk, urban obstetric population	Cross-sectional	Meconium analysis and medical record review	*n* = 3010	Postpartum women and neonates	Recreational drugs- cocaine, morphine and cannabis	N/A	N/A	44%	N/A	44%
Aviv et al	1993	South Africa	Record the prevalence of medication use in the antenatal period	Cross-sectional	Interview	*n* = 236	Pregnant women (3rd trimester)	Prescription and over-the-counter medications	59%	28.80%	N/A	N/A	71.20%
Berthier et al	1993	France	Determine the drugs prescribed during pregnancy	Cross-sectional	Interview with questionnaire	*n* = 225	Postpartum women (3 days after delivery)	Prescription and over-the-counter medications	88.10%	17.90%	N/A	N/A	99.50%
Buchi et al	1993	United States of America	Determine the prevalence of substance abuse among pregnant women	Cross-sectional	Urine analysis	*n* = 792	Pregnant women (3rd trimester)	Recreational drugs- marijuana, cocaine, amphetamines and alcohol	N/A	N/A	7.80%	N/A	7.80%
Vega et al	1993	United States of America	Identify the prevalence and demographic profiles associated with substance use during pregnancy	Cross-sectional	Urine analysis	*n* = 29 494	Postpartum women	Recreational drugs- amphetamines, barbiturates, benzodiazepines, cannabis, cocaine, methadone, opiates, phencyclidine and alcohol	N/A	N/A	11.35%	N/A	11.35%
Bonassi et al	1994	Italy	Investigate drug intake during pregnancy	Cross-sectional	Interview with questionnaire	*n* = 3112	Postpartum women (within 5 days of delivery)	Prescription and over-the-counter medications	N/A	N/A	N/A	N/A	82.7%
Heikkila et al	1994	Finland	Record the use of medications and the policy of prescribing during the course of pregnancy	Prospective cohort study	Questionnaire (filled by physician or nurse)	*n* = 5851	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription and over-the-counter medications	8%	15%	N/A	N/A	N/A
Kokotailo et al	1994	United States of America	Determine the prevalence of cigarette, alcohol and other drug use among small-city pregnant adolescents	Prospective cohort study	Self-administered questionnaire, urine toxicology and medical record review	*n* = 117	Pregnant adolescents	Recreational drugs- cigarette, alcohol and illicit drugs (amphetamines, benzodiazepines, cannabis, cocaine, opiates, phencyclidine and lysergic acid diethylamide	N/A	N/A	35%	N/A	35%
Martinez-Crespo et al	1994	Spain	Determine the prevalence of cocaine abuse during pregnancy	Cross-sectional	Self-completed structured questionnaire and urine toxicology	*n* = 1773	Postpartum women (immediately after delivery)	Recreational drug- cocaine	N/A	N/A	18.20%	N/A	18.20%
Stewart and Streiner	1994	Canada	Determine the prevalence of regular alcohol drinking during the second half of pregnancy	Cross-sectional	Self-completed questionnaire	*n* = 466	Pregnant women (2nd trimester)	Recreational drug- alcohol	N/A	N/A	22.70%	N/A	22.70%
Stewart and Streiner	1995	Canada	Determine the prevalence of regular smoking in the latter half of pregnancy	Cross-sectional	Self-completed questionnaire	*n* = 545	Pregnant women (2nd trimester)	Recreational drug- cigarette	N/A	N/A	16.30%	N/A	16.30%

Table 1 Articles included in the narrative literature review (continued)

Gilchrist et al	1996	United States of America	Investigate the substance use patterns of adolescent mothers	Prospective cohort study	Face-to-face interview and urine analysis	*n* = 229	Pregnant adolescents	Recreational drugs- cigarette, alcohol, marijuana, crack, cocaine, psychedelics, heroin, opium, amphetamines, barbiturates, tranquilizers and inhalants (such as sniffing glue, gasoline, etc)	N/A	N/A	16%	N/A	16%
Larivaara et al	1996	Finland	Investigate the use of psychotropic drugs and pregnancy outcome	Prospective cohort study	Self-administered questionnaire	*n* = 7933	Pregnant women (2nd and 3rd trimesters)	Prescription drugs- tranquilizers, hypnotics, antidepressants and lithium	1.50%	N/A	N/A	N/A	1.50%
Irl et al	1997	Germany	Evaluate the recorded information on drug exposure during pregnancy with regard to teratogenic properties and to contribute to the quality assurance of medical treatment in pregnancy	Prospective cohort study	Medication form	*n* = 921	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription, over-the-counter and alternative medicines	N/A	N/A	N/A	N/A	83.60%
Mabina et al	1997	South Africa	Determine the prevalence of herbal medicine use during pregnancy	Cross-sectional	Interview with questionnaire	*n* = 577	Pregnant women (3rd trimester)	Herbal medicines	N/A	N/A	N/A	43.70%	43.70%
Massele et al	1997	Tanzania	Determine the use of antimalarial drugs during pregnancy	Prospective cohort study	Interview with structured questionnaire and antenatal card review	*n* = 200	Pregnant women (2nd trimester)	Prescription medications- antimalarials	75%	N/A	N/A	N/A	75%
Perham-Hester and Gessner	1997	United States of America	Examine the characteristics related to drinking during pregnancy	Cross-sectional	Self-completed postal questionnaire	*n* = 6973	Postpartum women (2 to 8 months after delivery)	Recreational drug- alcohol	N/A	N/A	9.20%	N/A	9.20%
Splinter et al	1997	United States of America	Determine overall medication use by prenatal patients	Cross-sectional	Personal interview and medical record review	*n* = 100	Postpartum women (within 4 days of delivery)	Prescription and over-the-counter medications	93%	94%	N/A	N/A	N/A
Jimenez et al	1998	Spain	Determine drug use before pregnancy and in the early period of pregnancy	Cross-sectional	Interview with structured questionnaire	*n* = 272	Pregnant women (1st trimester)	Prescription and over-the-counter medications	N/A	N/A	N/A	N/A	62%
Opaneye	1998	Nigeria	Determine the prevalence of use of traditional medicines in pregnancy and the asociation between the use of traditional medicines and obstetric outcomes	Cross-sectional	Interview with structured questionnaire and case note review	*n* = 300	Postpartum women (within 2 days of delivery)	Traditional medicines	N/A	N/A	N/A	53.30%	53.30%

Table 1 Articles included in the narrative literature review (continued)

Teagle and Brindis	1998	United States of America	Investigate substance use among pregnant adolescents and to compare self-reported use and provider perception	Cross-sectional	In-person interview and self-administered questionnaire	*n* = 248	Pregnant adolescents (1st trimester)	Substance use- cigarette, alcohol, marijuana, cocaine and crack	N/A	N/A	49%	N/A	49%
Olesen et al	1999	Denmark	Examine the drug prescription pattern from 12 weeks prior to conception until 12 weeks post-partum	Retrospective cohort study	Prescription database and Medical birth registry	*n* = 16 001	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medications	44.20%	N/A	N/A	N/A	44.20%
Donati et al	2000	Italy	Describe the use of drugs during pregnancy	Cross-sectional	Interview with questionnaire	*n* = 9004	Postpartum women (within 2 months of delivery)	Prescription medications	75%	N/A	N/A	N/A	75%
Gharoro and Igbafe	2000	Nigeria	Determine the pattern and extent of drug consumption amongst pregnant women	Cross-sectional	Interview with structured questionnaire	*n* = 1200	Pregnant women (any trimester)	Prescription, herbal and recreational drugs (cigarette)	19.75%	N/A	0.42%	12.08%	N/A
Henry and Crowther	2000	Australia	Provide information on the patterns of medication use during and in the 3 months prior to pregnancy	Cross-sectional	Structured interview and medical record review	*n* = 140	Pregnant women (any trimester)	Prescription and over-the-counter medications	N/A	N/A	N/A	N/A	96.50%
Lester et al	2001	United States of America	Describe drug use by pregnant women	Cross-sectional	Structured interview and meconium toxicology	*n* = 11 811	Postpartum women and neonates (shortly after delivery)	Recreational drugs- cocaine and opiate	N/A	N/A	10.70%	N/A	10.70%
Nordeng et al	2001	Norway	Estimate the impact of maternal illness and prior pregnancy outcome on the use of drugs in early pregnancy	Cross-sectional	Structured interview	*n* = 1945	Pregnant women (early 2nd trimester)	Prescription medications	29%	N/A	N/A	N/A	29%
Bauer et al	2002	United States of America	Determine the effects of exposure to illicit drugs during pregnancy on the mother, fetus and infant	Cross-sectional	Interview with questionnaire and meconium analysis	*n* = 1185	Postpartum women and neonates (within 7 days of delivery)	Recreational drugs- cocaine, opiate, alcohol, tobacco and marijuana	N/A	N/A	13%	N/A	13%
Fergusson et al	2002	United Kingdom	Determine the prevalence of cannabis use in pregnancy, the association between its use and lifestyle factors and assessment of its effects on pregnancy outcome	Prospective cohort study	Self-completed postal questionnaire	*n* = 12 129	Pregnant women (2nd trimester)	Cannabis	N/A	N/A	2.30%	N/A	2.30%
Hayes et al	2002	United States of America	Examine prenatal alcohol intake in a rural, caucasian clinic	Cross-sectional	Medical record review	*n* = 212	Pregnant women (1st trimester)	Recreational drug- alcohol	N/A	N/A	30%	N/A	30%

Table 1 Articles included in the narrative literature review (continued)

Hepner et al	2002	United States of America	Determine the prevalence and pattern of use of herbal and over-the-counter medicines in pregnancy	Cross-sectional	Self-completed postal questionnaire	*n* = 734	Pregnant women (2nd trimester)	Herbal remedies (echinacea, St. John's wort and ephedra) and over-the-counter medications (cold remedies, pain relievers and heartburn medications)	N/A	75.60%	N/A	7.10%	N/A
Hollyer et al	2002	Canada	Examine the prevalence and supervision of the use of complementary and alternative medicine in treating nausea and vomiting	Cross-sectional	Telephone survey using structured questionnaire	*n* = 70	Pregnant women	Complementary and alternative therapies: ginger, vitamin B6 and acupressure	N/A	N/A	N/A	61%	61%
Maats and Crowther	2002	Australia	Assess medicines used preconceptionally and during pregnancy	Cross-sectional	Semi-structured interview	*n* = 211	Pregnant women (3rd trimester)	Over-the-counter and herbal medicines	N/A	N/A	N/A	N/A	62%
Pinn and Pallett	2002	Australia	Determine the use of alternative medical therapy in an antenatal population	Cross-sectional	Self-completed questionnaire	*n* = 305	Pregnant women (2nd trimester)	Herbal medicines, vitamin supplements, homeopathy, aromatherapy, iridology and acupuncture	N/A	N/A	N/A	40%	40%
Ebrahim and Gfroerer	2003	United States of America	Estimate the national prevalence of pregnancy-related illicit drug use and abstinence rates	Cross-sectional	Interview	*n* = 1249	Pregnant women (any trimester)	Marijuana/hashish, cocaine/crack, inhalants, hallucinogens and heroin	N/A	N/A	2.80%	N/A	2.80%
Glover et al	2003	United States of America	Identify the medications that are used by a rural obstetric population	Prospective cohort study	Interview	*n* = 578	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription, over-the-counter and herbal medicines	95.80%	92.60%	N/A	45.20%	N/A
Li et al	2003	United States of America	Evaluate prenatal use of non-steroidal anti-inflammatory drugs (NSAIDS), aspirin and paracetamol and its association with increased risk of miscarriage	Prospective cohort study	In-person interview	*n* = 1055	Pregnant women (1st trimester)	Over-the-counter medications- NSAIDS, aspirin and paracetamol	N/A	5%	N/A	N/A	5%
Andrade et al	2004	United States of America	Provide information on the prevalence of use of prescription drugs among pregnant women	Retrospective cohort study	Databases	*n* = 152 531	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medicines	64%	N/A	N/A	N/A	64%
Durisova and Magulova	2004	Slovakia	Determine the consumption of drugs and compliance with therapy in pregnancy	Cross-sectional	Self-administered structured questionnaire	*n* = 331	Postpartum women	Prescription and over-the-counter medications	N/A	N/A	N/A	N/A	75%
Egen-Lappe and Hasford	2004	Germany	Examine the prescription of drugs prior to, during and after pregnancy	Retrospective cohort study	Prescription database	*n* = 41 293	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medicines	96.40%	N/A	N/A	N/A	96.40%
Gilchrist et al	2004	Australia	Determine smoking practices during pregnancy and breastfeeding	Cross-sectional	Interview using Questionnaire	*n* = 425	Postpartum women	Recreational drug- cigarette	N/A	N/A	66.90%	N/A	66.90%

Table 1 Articles included in the narrative literature review (continued)

Headley et al	2004	United Kingdom	Investigate the prevalence of use of all types of medicinal products in pregnancy	Prospective cohort study	Self-completed postal questionnaire	*n* = 11 545	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription, over-the-counter, herbal and homeopathic products and other supplements	N/A	N/A	N/A	N/A	92.40%
Nordeng and Havnen	2004	Norway	Investigate the use of herbal drugs by pregnant women	Cross-sectional	Interview with structured questionnaire	*n* = 400	Postpartum women (within 3 days of delivery)	Herbal drugs- echinacea, iron-rich herbs, ginger, chamomile and cranberry	N/A	N/A	N/A	36%	36%
Zolnierczuk-Kieliszek et al	2004	Poland	Determine the frequency and intensity of tobacco smoking by pregnant women	Cross-sectional	Self-completed questionnaire	*n* = 100	Pregnant women	Recreational drug- cigarette	N/A	N/A	18%	N/A	18%
Chasnoff et al	2005	United States of America	Determine the prevalence of substance use among pregnant women	Cross-sectional	Questionnaire and structured clinical interview	*n* = 4865	Pregnant women	Illicit drugs- marijuana, heroin,cocaine and methamphetamines	N/A	N/A	9%	N/A	9%
Checa et al	2005	Spain	Assess the drug intake behaviour of immigrants during pregnancy	Cross-sectional	Interview with structured questionnaire and medical record review	*n* = 1103	Postpartum women	Prescription and over-the-counter medicines	N/A	N/A	N/A	N/A	74.60%
Pichini et al	2005	Spain	Estimate the prevalence of drug use by pregnant women and the effects on the mother, fetus and infant	Prospective cohort study	Structured interview and meconium analysis	*n* = 1151	Pregnant women (any trimester) and neonates	Recreational drugs- opiates, cocaine, MDMA and arecoline	N/A	N/A	7.90%	N/A	7.90%
Refuerzo et al	2005	United States of America	Determine the frequency of prescription, over-the-counter and herbal medicines use by pregnant women	Cross-sectional	Self-completed questionnaire	*n* = 418	Postpartum women	Prescription, over-the-counter and herbal medicines	76.50%	62.80%	N/A	4.10%	96.90%
Riley et al	2005	United States of America	Determine the correlates of prescription drug use during pregnancy	Prospective cohort study	Telephone survey and medical record review	*n* = 1626	Pregnant women	Prescription drugs- antibiotics, analgesics, asthma medications and antiemetics	56%	N/A	N/A	N/A	56%
Uncu et al	2005	Turkey	Evaluate maternal and paternal smoking habits during pregnancy and their correlation with pregnancy complications and newborn status	Cross-sectional	Face-to-face interview using questionnaire	*n* = 499	Postpartum women	Recreational drug- cigarette	N/A	N/A	9.80%	N/A	9.80%
Bakker et al	2006	The Netherlands	Investigate presription of drugs in women before, during and after pregnancy	Retrospective cohort study	Pharmacy database	n = 5412	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medications	N/A	N/A	N/A	N/A	79.10%
Chuang et al	2006	Taiwan	Investigate herbal medicine use during pregnancy and major congenital malformations	Prospective cohort study	Interview using structured questionnaire	*n* = 14 551	Pregnant women (3rd trimester)	Herbal medicines- An-Tai-Yin, huanglian and ginseng	N/A	N/A	N/A	16.90%	16.90%

Table 1 Articles included in the narrative literature review (continued)

Forster et al	2006	Australia	Determine the prevalence and attitude towards herbal medicine use in pregnant women	Cross-sectional	Self-administered questionnaire	*n* = 588	Pregnant women (3rd trimester)	Herbal supplements: raspberry leaf, ginger and chamomile	N/A	N/A	N/A	36%	36%
Olesen et al	2006	Denmark	Examine the association between socio-economic factors and use of prescription medication during pregnancy	Retrospective cohort study	Birth registry and Prescription database	*n* = 19 874	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medications	46.80%	N/A	N/A	N/A	46.80%
Ververs et al	2006	The Netherlands	Determine the extent and patterns of antidepressant use before, during and after pregnancy	Retrospective cohort study	Health care records and prescription database	*n* = 29 005	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medications-antidepressants	1.90%	N/A	N/A	N/A	1.90%
Chuang et al	2007	Taiwan	Investigate the prevalence of Chinese herbal medicines use by pregnant women	Cross-sectional	Interview with structured questionnaire	*n* = 1783	Postpartum women (6 months after delivery)	Chinese herbal medicines-An-Tai-Yin, pearl powder, huanglian, szu-wu-tang and ginseng	N/A	N/A	N/A	24.10%	24.10%
Garcia-Bournissen et al	2007	Canada	Identify and quantify methamphetamine and other drugs of abuse in maternal and neonatal hair	Cross-sectional	Hair analysis	*n* = 8270	Postpartum women and neonates	Recreational drugs-methamphetamine, cocaine, cannabis and opiates	N/A	N/A	60%	N/A	60%
Lozano et al	2007	Spain	Investigate the prevalence of in utero exposure of neonates to cannabis	Cross-sectional	Structured interview and meconium analysis	*n* = 974	Postpartum women and neonates	Recreational drug- cannabis	N/A	N/A	5.30%	N/A	5.30%
Andrade et al	2008	United States of America	Provide information on the prevalence of use of cardiovascular drugs among pregnant women	Retrospective cohort study	Databases	*n* = 118 935	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medicines-antihypertensives and antihyperlipidemics	3.20%	N/A	N/A	N/A	3.20%
Dal Pizzol et al	2008	Brazil	Evaluate the association between the use of misoprostol and other drugs to induce menstruation and congenital anomalies	Prospective cohort study	Structured interview and medical chart review	*n* = 4856	Pregnant women (late 2nd or early 3rd trimester)	Prescription drug-misoprostol; Complementary therapy-herbal teas (senna, marcela and quinine)	17%	N/A	N/A	34.40%	14.60%
Engeland et al	2008	Norway	Determine the use of prescription drugs before and during pregnancy	Retrospective cohort study	Birth registry and Prescription database	*n* = 106 329	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medications	57%	N/A	N/A	N/A	57%
Gagne et al	2008	Italy	Estimate the prevalence of prescription drug use among pregnant women	Retrospective cohort study	Healthcare database	*n* = 33 343	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medicines	70%	N/A	N/A	N/A	70%
Garcia-Algar et al	2008	Spain	Assess the prevalence of gestational ethanol exposure in neonates	Cross-sectional	Meconium analysis and medical record review	*n* = 353	Postpartum women and neonates	Recreational drug- alcohol	N/A	N/A	45%	N/A	45%
Holst et al	2008	Sweden	Study the characteristics of women using herbal drugs and impact of use in early pregnancy on pregnancy outcome	Retrospective cohort study	Medical birth registry	*n* = 860 215	Pregnant women (1st trimester)	Herbal drugs- Floradix, ginseng and valerian	N/A	N/A	N/A	0.90%	0.90%

Table 1 Articles included in the narrative literature review (continued)

Lapi et al	2008	Italy	Explore pregnant women's use, attitudes, knowledge and beliefs of complementary and alternative drugs	Cross-sectional	Face-to-face interview using semi-structured questionnaire	*n* = 150	Pregnant women (3rd trimester)	Complementary and alternative drugs- almond oil, propolis, fennel, arnica, St. John's wort, vegetable carbon, lemon balm, chamomile and mauve	N/A	N/A	N/A	48%	48%
Marcus and Flynn	2008	United States of America	Describe the prenatal patterns of antidepressant use and their relationship to depression in pregnancy	Cross-sectional	Structured clinical interview	*n* = 276	High risk pregnant women (2nd or 3rd trimester)	Prescription medications-antidepressants	13%	N/A	N/A	N/A	13%
Schempf and Strobino	2008	United States of America	Examine the association between adverse birth outcomes and drug use in pregnancy	Cross-sectional	Interview with questionnaire, medical record review and urine toxicology	*n* = 808	Postpartum women	Recreational drugs-cocaine, opiates, marijuana, cigarette and alcohol	N/A	N/A	25%	N/A	25%
Skouteris et al	2008	Australia	Explore the use of complementary and alternative medicines during pregnancy and women's perceptions of the safety of the medicines	Cross-sectional	Self-report postal questionnaire	*n* = 321	Pregnant women (late 2nd or early 3rd trimester)	Complementary and alternative medicines	N/A	N/A	N/A	73%	73%
Chuang et al	2009	Taiwan	Investigate the use of Chinese herbal medicines during pregnancy and the postpartum period	Cross-sectional	Interview using structured questionnaire	*n* = 21 248	Postpartum women (6 months after delivery)	Chinese herbal medicines-An-Tai-Yin, pearl powder, huanglian, szu-wu-tang and ginseng	N/A	N/A	N/A	33.60%	33.60%
Dal Pizzol et al	2009	Brazil	Evaluate the risk of adverse perinatal events among newborns exposed to dipyrone during gestation	Prospective cohort study	Interview with structured questionnaire and medical record review	*n* = 5564	Pregnant women (late 2nd or early 3rd trimester)	Over-the-counter medicine-dipyrone	N/A	11.50%	N/A	N/A	11.50%
Fakeye et al	2009	Nigeria	Determine the attitude and use of herbal medicines among pregnant women	Cross-sectional	Self-administered structured questionnaire	*n* = 595	Pregnant women	Herbal medicines	N/A	N/A	N/A	67.50%	67.50%
Gray et al	2009	United States of America	Determine prenatal amphetamine, methamphetamine and ecstasy use	Cross-sectional	Interview and meconium analysis	*n* = 3705	Postpartum women and neonates (shortly after delivery)	Amphetamine, methamphetamine and ecstasy	N/A	N/A	5.50%	N/A	5.50%
Harrison and Sidebottom	2009	United States of America	Examine alcohol and drug use before and during pregnancy and to identify the predictors of use cessation	Prospective cohort study	Structured clinical interview	*n* = 1492	Pregnant women (1st trimester)	Recreational drug- alcohol	N/A	N/A	5.60%	N/A	5.60%

Table 1 Articles included in the narrative literature review (continued)

Havens et al	2009	United States of America	Examine the prevalence and correlates of substance use during pregnancy	Cross-sectional	Computer-assisted self-interview	*n* = 1800	Pregnant women (any trimester)	Recreational drugs- alcohol, cigarettes, marijuana, prescription analgesics, tranquilizers, sedatives and stimulants, cocaine, crack, heroin and methamphetamine	N/A	N/A	25.80%	N/A	25.80%
Holst et al	2009	United Kingdom	Describe the use and user of herbal remedies during pregnancy and to study sources of information about herbs used	Cross-sectional	Self-administered questionnaire	*n* = 578	Pregnant women (2nd or 3rd trimester)	Herbal remedies- ginger, cranberry, raspberry leaf, chamomile, echinacea, peppermint, lavender, fennel, nettle and Floradix® (iron-rich herbs)	N/A	N/A	N/A	57.80%	57.80%
Kebede et al	2009	Ethiopia	Assess drug use among pregnant women	Cross-sectional	Interview with semi-structured questionnaire and antenatal card review	*n* = 1268	Pregnant women (any trimester)	Prescription medications	71.30%	N/A	N/A	N/A	71.30%
Kulaga et al	2009	Canada	Assess prescriptions filled by pregnant women for drugs with fetal harm and document the pregnancy outcomes	Retrospective cohort study	Pregnancy registry	*n* = 109 344	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medications	56%	N/A	N/A	N/A	56%
Lacroix et al	2009	France	Investigate the drugs prescribed and dispensed during pregnancy and the outcome of the pregnancies	Retrospective cohort study	Databases	*n* = 10 174	Pregnant women	Prescription drugs	93%	N/A	N/A	N/A	93%
Mashayekhi et al	2009	Iran	Examine the awareness of pregnant women about the effects of drugs in pregnancy	Cross-sectional	Self-completed questionnaire	*n* = 400	Pregnant and Postpartum women	Prescription and over-the-counter medications	N/A	N/A	N/A	N/A	18.80%
Moussally et al	2009	Canada	Determine the prevalence and predictors of herbal products use during pregnancy	Cross-sectional	Self-completed postal questionnaire	*n* = 3354	Postpartum women (3 to 8 years after delivery)	Herbal products: chamomile, green tea, peppermint and flax	N/A	N/A	N/A	9%	9%
Senn et al	2009	Papua New Guinea	Investigate the habit of betel nut chewing and its impact on pregnancy	Cross-sectional	Interview with semi-structured questionnaire	*n* = 310	Postpartum women (3 days after delivery)	Recreational drug- betel nut	N/A	N/A	94%	N/A	94%
Viktil et al	2009	Norway	Explore the use of antirheumatic drugs in pregnant women	Retrospective cohort study	Prescription database and Medical birth registry	*n* = 1411	Pregnant women	Antirheumatic drugs- Prednisolone, NSAIDs, sulfazalazine, hydroxychloroquine, azathioprine, methotrexate, leflunomide, etanercept and adalimumab	28%	N/A	N/A	N/A	28%

Table 1 Articles included in the narrative literature review (continued)

Yeh et al	2009	Taiwan	Investigate the patterns of traditional Chinese medicine use among pregnant women	Retrospective cohort study	Health Insurance database	*n* = 196 350	Pregnant women (1st, 2nd and 3rd trimesters)	Traditional Chinese medicine	N/A	N/A	N/A	20.90%	20.90%
Bercaw et al	2010	United States of America	Investigate the prevalence, reasons for use and physician-patient level of communication about the use of herbs, vitamins, over-the-counter and prescription medications in pregnancy	Cross-sectional	Self-administered questionnaire	*n* = 485	Postpartum women (immediately after delivery)	Herbs, vitamin supplements, over-the-counter medications and prescription medicines	29%	23%	N/A	19%	N/A
Bessa et al	2010	Brazil	Compare the self-report of drug use by pregnant adolescents with their hair analysis	Cross-sectional	Interview with structured questionnaire and hair analysis	*n* = 1000	Postpartum adolescents (within 2 days of delivery)	Recreational drugs- cocaine and marijuana	N/A	N/A	0.30%	N/A	0.30%
Cleary et al	2010	Republic of Ireland	Examine the extent, nature and determinants of medication use in early pregnancy	Cross-sectional	Face-to-face interview	*n* = 61 252	Pregnant women (1st trimester)	Prescription, over-the-counter, herbal and illicit drugs	39.20%	19.50%	0.90%	0.58%	N/A
Cuzzolin et al	2010	Italy	Explore the use of herbal products in pregnancy and possible effects of its use on pregnancy outcome	Cross-sectional	Face-to-face interview using prestructured questionnaire	*n* = 392	Postpartum women (within 3 days of delivery)	Herbal products- chamomile, licorice, fennel, aloe, valerian, echinacea, almond oil, propolis and cranberry	N/A	N/A	N/A	27.80%	27.80%
Falcon et al	2010	Spain	Investigate the prevalence of drug use in pregnancy and the relationship between drug exposure and induced abortions	Cross-sectional	Self-administered structured questionnaire and serum and hair testing	*n* = 142	Pregnant women (1st trimester)	Recreational drugs- cannabis, cocaine, opiates and MDMA (ecstasy)	N/A	N/A	30%	N/A	30%
Irvine et al	2010	United Kingdom	Investigate the patterns of prescribing of drugs to women who gave birth in Scotland	Retrospective cohort study	Maternity records and Prescription database	*n* = 3937	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription drugs	85.20%	N/A	N/A	N/A	85.20%
Kalder et al	2010	Germany	Assess the use of complementary and alternative medicines in pregnancy and reasons for use	Cross-sectional	Self-report questionnaire	*n* = 205	Postpartum women	Homeopathy, acupuncture and phytotherapy	N/A	N/A	N/A	50.70%	50.70%
van Gelder et al	2010	United States of America	Determine the prevalence of self-reported illicit drug use during pregnancy and its association with demographic and social factors	Cross-sectional	Telephone interview	*n* = 5871	Postpartum women (between 6 weeks and 24 months after delivery)	Recreational drugs- cannabis, cocaine and stimulants	N/A	N/A	3.60%	N/A	3.60%
Zhu et al	2010	China	Describe the pattern of drug use during the first trimester and to examine the impact of maternal diseases on choice of drugs	Cross-sectional	Self-completed questionnaire and maternal handbook review	*n* = 4290	Pregnant women (1st trimester)	Prescription, over-the-counter and traditional medicines	N/A	N/A	N/A	10.10%	75.90%

Table 1 Articles included in the narrative literature review (continued)

Al-Riyami et al	2011	Oman	Evaluate medication use pattern in pregnant women	Prospective cohort study	Interview with structured questionnaire and electronic patient record	*n* = 139	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription, over-the-counter and herbal medicines	N/A	N/A	N/A	23.80%	48.50%
Bello et al	2011	Nigeria	Assess the drug use profile of an antenatal population	Cross-sectional	Self-administered questionnaire	*n* = 410	Pregnant women (any trimester)	Over-the-counter and herbal medicines	N/A	19.20%	N/A	46.30%	N/A
Bishop et al	2011	United Kingdom	Report the frequency of complementary and alternative medicine use by a population of pregnant women	Prospective cohort study	Self-completed postal questionnaire	*n* = 14 115	Pregnant women (1st, 2nd and 3rd trimesters)	Complementary and alternative medicines	N/A	N/A	N/A	26.70%	26.70%
Chang et al	2011	United States of America	Describe the prevalence and factors associated with self-reported substance use in young pregnant women	Cross-sectional	Mail survey and diagnostic interview	*n* = 30	Pregnant young adults (2nd trimester)	Alcohol and marijuana	N/A	N/A	33.30%	N/A	33.30%
Crespin et al	2011	France	Describe the prescribing of drugs to pregnant women before and during pregnancy	Retrospective cohort study	Pharmacy records of the health insurance service	*n* = 23 898	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medicines	95.60%	N/A	N/A	N/A	95.60%
Malan and Neuba	2011	Cote d'Ivoire	Determine medicinal plants used, the associated practices and reasons for such practices by pregnant women	Cross-sectional	Interview with questionnaire	*n* = 55	Pregnant women (any trimester)	Herbal medicines	N/A	N/A	N/A	90.30%	90.30%
Nordeng et al	2011	Norway	Investigate the use of herbal drugs by pregnant women in relation to concurrent use of conventional drugs, delivery, and pregnancy outcome	Cross-sectional	Interview with structured questionnaire and medical birth charts	*n* = 600	Postpartum women (within 5 days of delivery)	Herbal medicines	N/A	N/A	N/A	39.70%	39.70%
Sawicki et al	2011	Australia	Study the extent and nature of the use of prescribed medications during pregnancy and factors associated with medication nonadherence	Cross-sectional	Self-completed questionnaire	*n* = 819	Pregnant women (3rd trimester)	Prescription medicines	26.50%	N/A	N/A	N/A	26.50%
Stephansson et al	2011	Sweden	Study drug use during pregnancy and agreement between antenatal records and dispensed drugs from pharmacy database	Retrospective cohort study	Medical birth register and Prescribed drug register	*n* = 102 995	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medicines	57.60%	N/A	N/A	N/A	57.60%
Yusuff and Omarusehe	2011	Nigeria	Assess the frequency and evaluate the factors underlining self-medication with orthodox and herbal medicines among pregnant women	Cross-sectional	Interview with questionnaire	*n* = 1594	Pregnant women (any trimester)	Prescription, over-the-counter and herbal medicines	N/A	N/A	N/A	31.20%	63.80%

Table 1 Articles included in the narrative literature review (continued)

Abasiubong et al	2012	Nigeria	Assess the level of self-medication among pregnant women	Cross-sectional	Self-report questionnaire	*n* = 518	Pregnant women	Prescription, over-the-counter, herbal medicines, and alcohol	27.60%	41.90%	3.50%	9.10%	72.40%
Bertoldi et al	2012	Brazil	Estimate the exposure to medicines with unknown foetal risk during pregnancy	Cross-sectional	Interview with questionnaire	*n* = 4189	Postpartum women (within 24 hours of delivery)	Prescription and over-the-counter medications	N/A	N/A	N/A	N/A	92.70%
Daw et al	2012	Canada	Measure the frequency, timing and type of medicines used before, during and after pregnancy	Retrospective cohort study	Health care records and prescription drug claims	*n* = 163 082	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medicines	63.50%	N/A	N/A	N/A	63.50%
Friguls et al	2012	Spain	Estimate the prevalence of drug use by pregnant women	Cross-sectional	Structured questionnaire and maternal hair analysis	*n* = 107	Postpartum women (1 day after delivery)	Cannabis, cocaine and MDMA	N/A	N/A	16%	N/A	16%
Hayatbakhsh et al	2012	Australia	Examine association between cannabis use before and during pregnancy and birth outcomes	Prospective cohort study	Interview with questionnaire and medical records	*n* = 24 874	Pregnant women (2nd trimester)	Recreational drug- cannabis	N/A	N/A	2.60%	N/A	2.60%
Joya et al	2012	Spain	Estimate the prevalence of illicit drug use among pregnant women	Cross-sectional	Structured questionnaire and maternal hair analysis	*n* = 347	Postpartum women (1 day after delivery)	Cocaine	N/A	N/A	2.60%	N/A	2.60%
Khadivzadeh and Ghabel	2012	Iran	Assess the use of traditional/complementary and alternative medicine during pregnancy	Cross-sectional	Self-report questionnaire	*n* = 919	Pregnant women (1st, 2nd and 3rd trimesters)	Complementary and alternative medicines	N/A	N/A	N/A	83.70%	83.70%
Kratz and Vaughan	2012	United States of America	Examine the predictors of cigarette use in pregnant women	Cross-sectional	Computer-assisted in-home interview	*n* = 1782	Pregnant women (2nd or 3rd trimester)	Cigarette	N/A	N/A	18.90%	N/A	18.90%
Mureyi et al	2012	Zimbabwe	Determine the prevalence of prenatal use of traditional medicine within a sample of women	Cross-sectional	Interview with questionnaire	*n* = 248	Postpartum women (6 weeks after delivery)	Traditional medicines	N/A	N/A	N/A	52%	52%
Nordeng et al	2012	Norway	Study the associations between medication use, fear of childbirth, and maternal mental health	Prospective cohort study	Self-completed questionnaire	*n* = 1984	Pregnant women (2nd and 3rd trimesters)	Prescription and over-the-counter medications	N/A	N/A	N/A	N/A	57.70%
Odalovic et al	2012	Serbia	Investigate prescription and over-the-counter drug use before and during pregnancy	Cross-sectional	Self-report questionnaire	*n* = 311	Pregnant women (2nd trimester)	Prescription and over-the-counter medications	27.30%	8.70%	N/A	N/A	34.70%
Passey et al	2012	Australia	Describe women's self-reported antenatal smoking behaviour	Cross-sectional	Self-completed questionnaire	*n* = 264	Pregnant women (3rd trimester)	Recreational drug- cigarette	N/A	N/A	46%	N/A	46%
Vythilingum et al	2012	South Africa	Study the prevalence of substance use in an antenatal population	Cross-sectional	Self-report questionnaire	*n* = 323	Pregnant women (any trimester)	Recreational substances	N/A	N/A	4%	N/A	4%

Table 1 Articles included in the narrative literature review (continued)

Ystrom et al	2012	Norway	Examine the role of personality in a pregnant woman's consumption of medications and alcohol	Cross-sectional	Internet questionnaire	*n* = 835	Pregnant women (any trimester)	Prescription, over-the-counter, herbal medicines and alcohol	1.90%	58.80%	7.40%	8.90%	N/A
Baraka et al	2013	Belgium	Investigate the differences in exposure to medications in a cohort of multi-ethnic pregnant women	Cross-sectional	Self-completed questionnaire	*n* = 641	Pregnant women (2nd or 3rd trimester)	Prescription and over-the-counter medications	N/A	N/A	N/A	N/A	83.80%
Gardiner et al	2013	United States of America	Determine the prevalence of herb and vitamin use in a population of underserved postpartum women and types of herbs used	Cross-sectional	Interview with questionnaire and medical chart review	*n* = 160	Postpartum women	Herbal medicines and vitamins	N/A	65%	N/A	39%	N/A
Hall and Jolly	2013	United Kingdom	Determine the prevalence of women's use of complementary and alternative medicines during pregnancy and reasons for use	Cross-sectional	Interview with questionnaire	*n* = 315	Postpartum women	Complementary and alternative medicines	N/A	N/A	N/A	57.10%	57.10%
Lendoiro et al	2013	Spain	Compare maternal interview and hair analysis to determine drug consumption throughout pregnancy and study relations among maternal interview, hair results, and neonatal outcomes	Cross-sectional	Interview with questionnaire and maternal hair analysis	*n* = 209	Postpartum women	Illicit drugs- cocaine, cannabis, opiates, methadone, and ketamine	N/A	N/A	15.40%	N/A	15.40%
Mallard et al	2013	New Zealand	Describe the prevalence and patterns of alcohol intake among pregnant women	Cross-sectional	Self-administered questionnaire	*n* = 723	Postpartum women	Alcohol	N/A	N/A	34%	N/A	34%
Rachidi et al	2013	Lebanon	Assess risky exposure of pregnant women to drugs, tobacco and caffeine and determine their effect on postnatal outcomes	Cross-sectional	Interview with questionnaire and medical files	*n* = 350	Postpartum women (1 day after delivery)	Prescription, over-the-counter medicines, and cigarette	34.90%	66%	6.30%	N/A	N/A
Santiago et al	2013	United States of America	Describe maternal intake of food, drink, and medication during pregnancy	Cross-sectional	Self-completed questionnaire	*n* = 200	Pregnant women (3rd trimester) and Postpartum women (8 weeks after delivery)	Over-the-counter medicines and alcohol	N/A	28.90%	5.80%	N/A	N/A

1.2.5.1 Geographical distribution of the articles

The studies were from different parts of the world - United States (n = 36), South Africa (n = 3), The Netherlands (n = 2), France (n = 3), Brazil (n = 4), Italy (n = 6), Spain (n = 10), Taiwan (n = 4), Republic of Ireland (n = 1), Australia (n = 10), Slovakia (n = 1), Germany (n = 3), Norway (n = 7), Nigeria (n = 6), United Kingdom (n = 8), Canada (n = 7), Finland (n = 2), Sweden (n = 2), Belgium (n = 1), Lebanon (n = 1), New Zealand (n = 1), Zimbabwe (n = 1), Serbia (n = 1), Cote d'Ivoire (n = 1), Ethiopia (n = 1), Iran (n = 2), Tanzania (n = 1), Denmark (n = 2), Papua New Guinea (n = 1), Turkey (n = 1), China (n = 1), Poland (n = 1) and Oman (n = 1). The articles reported a wide variation in the prevalence of medicine and recreational substance use in pregnancy. Differences in study objectives, population characteristics, study design, data collection methods, sample sizes and focus on different time frames of pregnancy and the postpartum period are factors that may have contributed to the disparities. It is also apparent from the reports that use of medicines vary between countries, making comparison between studies and interpretation of results difficult (Table 2). For example, a WHO sponsored study carried out in 1987 in 22 countries reported that there was a marked variation in medicine use in the countries that participated in the study. The differences reflect the broad spectrum of medical care, public health problems, and cultural differences between countries (C.G.D.U.P., 1992). Even with such differences, most of the research concluded that the consumption of medicines is common among pregnant women.

Table 2 Geographical distribution of the articles

Author	Year of study	Country	Objectives of the study	Methods		Population characteristics		Type of medicine or substance studied	Prevalence of use				
				Study design	Data collection	Sample size	Study participants		Prescription medicines	Over-the-counter medications	Recreational drugs or substances	Complementary & alternative medicines	Overall
Correy et al	1991	Australia	Investigate the use of prescription drugs in the first trimester and congenital malformations	Prospective cohort study	Medical form (filled by doctors)	*n* = 56 037	Pregnant women (1st trimester)	Prescription medicines	30.90%	N/A	N/A	N/A	30.90%
Forster et al	2006	Australia	Determine the prevalence and attitude towards herbal medicine use in pregnant women	Cross-sectional	Self-administered questionnaire	*n* = 588	Pregnant women (3rd trimester)	Herbal supplements: raspberry leaf, ginger and chamomile	N/A	N/A	N/A	36%	36%
Gilchrist et al	2004	Australia	Determine smoking practices during pregnancy and breastfeeding	Cross-sectional	Interview using Questionnaire	*n* = 425	Postpartum women	Recreational drug- cigarette	N/A	N/A	66.90%	N/A	66.90%
Hayatbakhsh et al	2012	Australia	Examine association between cannabis use before and during pregnancy and birth outcomes	Prospective cohort study	Interview with questionnaire and medical records	*n* = 24 874	Pregnant women (2nd trimester)	Recreational drug- cannabis	N/A	N/A	2.60%	N/A	2.60%
Henry and Crowther	2000	Australia	Provide information on the patterns of medication use during and in the 3 months prior to pregnancy	Cross-sectional	Structured interview and medical record review	*n* = 140	Pregnant women (any trimester)	Prescription and over-the-counter medications	N/A	N/A	N/A	N/A	96.50%
Maats and Crowther	2002	Australia	Assess medicines used preconceptionally and during pregnancy	Cross-sectional	Semi-structured interview	*n* = 211	Pregnant women (3rd trimester)	Over-the-counter and herbal medicines	N/A	N/A	N/A	N/A	62%
Passey et al	2012	Australia	Describe women's self-reported antenatal smoking behaviour	Cross-sectional	Self-completed questionnaire	*n* = 264	Pregnant women (3rd trimester)	Recreational drug- cigarette	N/A	N/A	46%	N/A	46%
Pinn and Pallett	2002	Australia	Determine the use of alternative medical therapy in an antenatal population	Cross-sectional	Self-completed questionnaire	*n* = 305	Pregnant women (2nd trimester)	Herbal medicines, vitamin supplements, homeopathy, aromatherapy, iridology and acupuncture	N/A	N/A	N/A	40%	40%
Sawicki et al	2011	Australia	Study the extent and nature of the use of prescribed medications during pregnancy and factors associated with medication nonadherence	Cross-sectional	Self-completed questionnaire	*n* = 819	Pregnant women (3rd trimester)	Prescription medicines	26.50%	N/A	N/A	N/A	26.50%
Skouteris et al	2008	Australia	Explore the use of complementary and alternative medicines during pregnancy and women's perceptions of the safety of the medicines	Cross-sectional	Self-report postal questionnaire	*n* = 321	Pregnant women (late 2nd or early 3rd trimester)	Complementary and alternative medicines	N/A	N/A	N/A	73%	73%

Table 2 Geographical distribution of the articles (continued)

Baraka et al	2013	Belgium	Investigate the differences in exposure to medications in a cohort of multi-ethnic pregnant women	Cross-sectional	Self-completed questionnaire	*n* = 641	Pregnant women (2nd or 3rd trimester)	Prescription and over-the-counter medications	N/A	N/A	N/A	N/A	83.80%
Bertoldi et al	2012	Brazil	Estimate the exposure to medicines with unknown foetal risk during pregnancy	Cross-sectional	Interview with questionnaire	*n* = 4189	Postpartum women (within 24 hours of delivery)	Prescription and over-the-counter medications	N/A	N/A	N/A	N/A	92.70%
Bessa et al	2010	Brazil	Compare the self-report of drug use by pregnant adolescents with their hair analysis	Cross-sectional	Interview with structured questionnaire and hair analysis	*n* = 1000	Postpartum adolescents (within 2 days of delivery)	Recreational drugs- cocaine and marijuana	N/A	N/A	0.30%	N/A	0.30%
Dal Pizzol et al	2009	Brazil	Evaluate the risk of adverse perinatal events among newborns exposed to dipyrone during gestation	Prospective cohort study	Interview with structured questionnaire and medical record review	*n* = 5564	Pregnant women (late 2nd or early 3rd trimester)	Over-the-counter medicine-dipyrone	N/A	11.50%	N/A	N/A	11.50%
Dal Pizzol et al	2008	Brazil	Evaluate the association between the use of misoprostol and other drugs to induce menstruation and congenital anomalies	Prospective cohort study	Structured interview and medical chart review	*n* = 4856	Pregnant women (late 2nd or early 3rd trimester)	Prescription drug-misoprostol; Complementary therapy-herbal teas (senna, marcela and quinine)	17%	N/A	N/A	34.40%	14.60%
Daw et al	2012	Canada	Measure the frequency, timing and type of medicines used before, during and after pregnancy	Retrospective cohort study	Health care records and prescription drug claims	*n* = 163 082	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medicines	63.50%	N/A	N/A	N/A	63.50%
Garcia-Bournissen et al	2007	Canada	Identify and quantify methamphetamine and other drugs of abuse in maternal and neonatal hair	Cross-sectional	Hair analysis	*n* = 8270	Postpartum women and neonates	Recreational drugs-methamphetamine, cocaine, cannabis and opiates	N/A	N/A	60%	N/A	60%
Hollyer et al	2002	Canada	Examine the prevalence and supervision of the use of complementary and alternative medicine in treating nausea and vomiting	Cross-sectional	Telephone survey using structured questionnaire	*n* = 70	Pregnant women	Complementary and alternative therapies: ginger, vitamin B6 and acupressure	N/A	N/A	N/A	61%	61%
Kulaga et al	2009	Canada	Assess prescriptions filled by pregnant women for drugs with fetal harm and document the pregnancy outcomes	Retrospective cohort study	Pregnancy registry	*n* = 109 344	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medications	56%	N/A	N/A	N/A	56%
Moussally et al	2009	Canada	Determine the prevalence and predictors of herbal products use during pregnancy	Cross-sectional	Self-completed postal questionnaire	*n* = 3354	Postpartum women (3 to 8 years after delivery)	Herbal products: chamomile, green tea, peppermint and flax	N/A	N/A	N/A	9%	9%

Table 2 Geographical distribution of the articles (continued)

Stewart and Streiner	1994	Canada	Determine the prevalence of regular alcohol drinking during the second half of pregnancy	Cross-sectional	Self-completed questionnaire	*n* = 466	Pregnant women (2nd trimester)	Recreational drug- alcohol	N/A	N/A	22.70%	N/A	22.70%
Stewart and Streiner	1995	Canada	Determine the prevalence of regular smoking in the latter half of pregnancy	Cross-sectional	Self-completed questionnaire	*n* = 545	Pregnant women (2nd trimester)	Recreational drug- cigarette	N/A	N/A	16.30%	N/A	16.30%
Zhu et al	2010	China	Describe the pattern of drug use during the first trimester and to examine the impact of maternal diseases on choice of drugs	Cross-sectional	Self-completed questionnaire and maternal handbook review	*n* = 4290	Pregnant women (1st trimester)	Prescription, over-the-counter and traditional medicines	N/A	N/A	N/A	10.10%	75.90%
Malan and Neuba	2011	Cote d'Ivoire	Determine medicinal plants used, the associated practices and reasons for such practices by pregnant women	Cross-sectional	Interview with questionnaire	*n* = 55	Pregnant women (any trimester)	Herbal medicines	N/A	N/A	N/A	90.30%	90.30%
Olesen et al	2006	Denmark	Examine the association between socio-economic factors and use of prescription medication during pregnancy	Retrospective cohort study	Birth registry and Prescription database	*n* = 19 874	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medications	46.80%	N/A	N/A	N/A	46.80%
Olesen et al	1999	Denmark	Examine the drug prescription pattern from 12 weeks prior to conception until 12 weeks post-partum	Retrospective cohort study	Prescription database and Medical birth registry	*n* = 16 001	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medications	44.20%	N/A	N/A	N/A	44.20%
Kebede et al	2009	Ethiopia	Assess drug use among pregnant women	Cross-sectional	Interview with semi-structured questionnaire and antenatal card review	*n* = 1268	Pregnant women (any trimester)	Prescription medications	71.30%	N/A	N/A	N/A	71.30%
Heikkila et al	1994	Finland	Record the use of medications and the policy of prescribing during the course of pregnancy	Prospective cohort study	Questionnaire (filled by physician or nurse)	*n* = 5851	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription and over-the-counter medications	8%	15%	N/A	N/A	N/A
Larivaara et al	1996	Finland	Investigate the use of psychotropic drugs and pregnancy outcome	Prospective cohort study	Self-administered questionnaire	*n* = 7933	Pregnant women (2nd and 3rd trimesters)	Prescription drugs- tranquilizers, hypnotics, antidepressants and lithium	1.50%	N/A	N/A	N/A	1.50%
Berthier et al	1993	France	Determine the drugs prescribed during pregnancy	Cross-sectional	Interview with questionnaire	*n* = 225	Postpartum women (3 days after delivery)	Prescription and over-the-counter medications	88.10%	17.90%	N/A	N/A	99.50%
Crespin et al	2011	France	Describe the prescribing of drugs to pregnant women before and during pregnancy	Retrospective cohort study	Pharmacy records of the health insurance service	*n* = 23 898	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medicines	95.60%	N/A	N/A	N/A	95.60%
Lacroix et al	2009	France	Investigate the drugs prescribed and dispensed during pregnancy and the outcome of the pregnancies	Retrospective cohort study	Databases	*n* = 10 174	Pregnant women	Prescription drugs	93%	N/A	N/A	N/A	93%

Table 2 Geographical distribution of the articles (continued)

Egen-Lappe and Hasford	2004	Germany	Examine the prescription of drugs prior to, during and after pregnancy	Retrospective cohort study	Prescription database	*n* = 41 293	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medicines	96.40%	N/A	N/A	N/A	96.40%
Irl et al	1997	Germany	Evaluate the recorded information on drug exposure during pregnancy with regard to teratogenic properties and to contribute to the quality assurance of medical treatment in pregnancy	Prospective cohort study	Medication form	*n* = 921	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription, over-the-counter and alternative medicines	N/A	N/A	N/A	N/A	83.60%
Kalder et al	2010	Germany	Assess the use of complementary and alternative medicines in pregnancy and reasons for use	Cross-sectional	Self-report questionnaire	*n* = 205	Postpartum women	Homeopathy, acupuncture and phytotherapy	N/A	N/A	N/A	50.70%	50.70%
Khadivzadeh and Ghabel	2012	Iran	Assess the use of traditional/complementary and alternative medicine during pregnancy	Cross-sectional	Self-report questionnaire	*n* = 919	Pregnant women (1st, 2nd and 3rd trimesters)	Complementary and alternative medicines	N/A	N/A	N/A	83.70%	83.70%
Mashayekhi et al	2009	Iran	Examine the awareness of pregnant women about the effects of drugs in pregnancy	Cross-sectional	Self-completed questionnaire	*n* = 400	Pregnant and Postpartum women	Prescription and over-the-counter medications	N/A	N/A	N/A	N/A	18.80%
Bonassi et al	1994	Italy	Investigate drug intake during pregnancy	Cross-sectional	Interview with questionnaire	*n* = 3112	Postpartum women (within 5 days of delivery)	Prescription and over-the-counter medications	N/A	N/A	N/A	N/A	82.7%
C.G.D.U.P. (Collaborative Group on Drug Use in Pregnancy)	1992	Italy	Assess the pattern of drug use in pregnancy	Cross-sectional	Interview using structured questionnaire	*n* = 14 778	Postpartum women (within 1st week of delivery)	Prescription and over-the-counter medications	N/A	N/A	N/A	N/A	86%
Cuzzolin et al	2010	Italy	Explore the use of herbal products in pregnancy and possible effects of its use on pregnancy outcome	Cross-sectional	Face-to-face interview using prestructured questionnaire	*n* = 392	Postpartum women (within 3 days of delivery)	Herbal products-chamomile, licorice, fennel, aloe, valerian, echinacea, almond oil, propolis and cranberry	N/A	N/A	N/A	27.80%	27.80%
Donati et al	2000	Italy	Describe the use of drugs during pregnancy	Cross-sectional	Interview with questionnaire	*n* = 9004	Postpartum women (within 2 months of delivery)	Prescription medications	75%	N/A	N/A	N/A	75%
Gagne et al	2008	Italy	Estimate the prevalence of prescription drug use among pregnant women	Retrospective cohort study	Healthcare database	*n* = 33 343	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medicines	70%	N/A	N/A	N/A	70%

Table 2 Geographical distribution of the articles (continued)

Lapi et al	2008	Italy	Explore pregnant women's use, attitudes, knowledge and beliefs of complementary and alternative drugs	Cross-sectional	Face-to-face interview using semi-structured questionnaire	*n* = 150	Pregnant women (3rd trimester)	Complementary and alternative drugs- almond oil, propolis, fennel, arnica, St. John's wort, vegetable carbon, lemon balm, chamomile and mauve	N/A	N/A	N/A	48%	48%
Rachidi et al	2013	Lebanon	Assess risky exposure of pregnant women to drugs, tobacco and caffeine and determine their effect on postnatal outcomes	Cross-sectional	Interview with questionnaire and medical files	*n* = 350	Postpartum women (1 day after delivery)	Prescription, over-the-counter medicines, and cigarette	34.90%	66%	6.30%	N/A	N/A
Mallard et al	2013	New Zealand	Describe the prevalence and patterns of alcohol intake among pregnant women	Cross-sectional	Self-administered questionnaire	*n* = 723	Postpartum women	Alcohol	N/A	N/A	34%	N/A	34%
Abasiubong et al	2012	Nigeria	Assess the level of self-medication among pregnant women	Cross-sectional	Self-report questionnaire	*n* = 518	Pregnant women	Prescription, over-the-counter, herbal medicines, and alcohol	27.60%	41.90%	3.50%	9.10%	72.40%
Bello et al	2011	Nigeria	Assess the drug use profile of an antenatal population	Cross-sectional	Self-administered questionnaire	*n* = 410	Pregnant women (any trimester)	Over-the-counter and herbal medicines	N/A	19.20%	N/A	46.30%	N/A
Fakeye et al	2009	Nigeria	Determine the attitude and use of herbal medicines among pregnant women	Cross-sectional	Self-administered structured questionnaire	*n* = 595	Pregnant women	Herbal medicines	N/A	N/A	N/A	67.50%	67.50%
Gharoro and Igbafe	2000	Nigeria	Determine the pattern and extent of drug consumption amongst pregnant women	Cross-sectional	Interview with structured questionnaire	*n* = 1200	Pregnant women (any trimester)	Prescription, herbal and recreational drugs (cigarette)	19.75%	N/A	0.42%	12.08%	N/A
Opaneye	1998	Nigeria	Determine the prevalence of use of traditional medicines in pregnancy and the asociation between the use of traditional medicines and obstetric outcomes	Cross-sectional	Interview with structured questionnaire and case note review	*n* = 300	Postpartum women (within 2 days of delivery)	Traditional medicines	N/A	N/A	N/A	53.30%	53.30%
Yusuff and Omarusehe	2011	Nigeria	Assess the frequency and evaluate the factors underlining self-medication with orthodox and herbal medicines among pregnant women	Cross-sectional	Interview with questionnaire	*n* = 1594	Pregnant women (any trimester)	Prescription, over-the-counter and herbal medicines	N/A	N/A	N/A	31.20%	63.80%
Engeland et al	2008	Norway	Determine the use of prescription drugs before and during pregnancy	Retrospective cohort study	Birth registry and Prescription database	*n* = 106 329	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medications	57%	N/A	N/A	N/A	57%
Nordeng and Havnen	2004	Norway	Investigate the use of herbal drugs by pregnant women	Cross-sectional	Interview with structured questionnaire	*n* = 400	Postpartum women (within 3 days of delivery)	Herbal drugs- echinacea, iron-rich herbs, ginger, chamomile and cranberry	N/A	N/A	N/A	36%	36%

Table 2 Geographical distribution of the articles (continued)

Nordeng et al	2001	Norway	Estimate the impact of maternal illness and prior pregnancy outcome on the use of drugs in early pregnancy	Cross-sectional	Structured interview	*n* = 1945	Pregnant women (early 2nd trimester)	Prescription medications	29%	N/A	N/A	N/A	29%
Nordeng et al	2011	Norway	Investigate the use of herbal drugs by pregnant women in relation to concurrent use of conventional drugs, delivery, and pregnancy outcome	Cross-sectional	Interview with structured questionnaire and medical birth charts	*n* = 600	Postpartum women (within 5 days of delivery)	Herbal medicines	N/A	N/A	N/A	39.70%	39.70%
Nordeng et al	2012	Norway	Study the associations between medication use, fear of childbirth, and maternal mental health	Prospective cohort study	Self-completed questionnaire	*n* = 1984	Pregnant women (2nd and 3rd trimesters)	Prescription and over-the-counter medications	N/A	N/A	N/A	N/A	57.70%
Viktil et al	2009	Norway	Explore the use of antirheumatic drugs in pregnant women	Retrospective cohort study	Prescription database and Medical birth registry	*n* = 1411	Pregnant women	Antirheumatic drugs- Prednisolone, NSAIDs, sulfazalazine, hydroxychloroquine, azathioprine, methotrexate, leflunomide, etanercept and adalimumab	28%	N/A	N/A	N/A	28%
Ystrom et al	2012	Norway	Examine the role of personality in a pregnant woman's consumption of medications and alcohol	Cross-sectional	Internet questionnaire	*n* = 835	Pregnant women (any trimester)	Prescription, over-the-counter, herbal medicines and alcohol	1.90%	58.80%	7.40%	8.90%	N/A
Al-Riyami et al	2011	Oman	Evaluate medication use pattern in pregnant women	Prospective cohort study	Interview with structured questionnaire and electronic patient record	*n* = 139	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription, over-the-counter and herbal medicines	N/A	N/A	N/A	23.80%	48.50%
Senn et al	2009	Papua New Guinea	Investigate the habit of betel nut chewing and its impact on pregnancy	Cross-sectional	Interview with semi-structured questionnaire	*n* = 310	Postpartum women (3 days after delivery)	Recreational drug- betel nut	N/A	N/A	94%	N/A	94%
Zolnierczuk-Kieliszek et al	2004	Poland	Determine the frequency and intensity of tobacco smoking by pregnant women	Cross-sectional	Self-completed questionnaire	*n* = 100	Pregnant women	Recreational drug- cigarette	N/A	N/A	18%	N/A	18%
Cleary et al	2010	Republic of Ireland	Examine the extent, nature and determinants of medication use in early pregnancy	Cross-sectional	Face-to-face interview	*n* = 61 252	Pregnant women (1st trimester)	Prescription, over-the-counter, herbal and illicit drugs	39.20%	19.50%	0.90%	0.58%	N/A
Odalovic et al	2012	Serbia	Investigate prescription and over-the-counter drug use before and during pregnancy	Cross-sectional	Self-report questionnaire	*n* = 311	Pregnant women (2nd trimester)	Prescription and over-the-counter medications	27.30%	8.70%	N/A	N/A	34.70%
Durisova and Magulova	2004	Slovakia	Determine the consumption of drugs and compliance with therapy in pregnancy	Cross-sectional	Self-administered structured questionnaire	*n* = 331	Postpartum women	Prescription and over-the-counter medications	N/A	N/A	N/A	N/A	75%

Table 2 Geographical distribution of the articles (continued)

Aviv et al	1993	South Africa	Record the prevalence of medication use in the antenatal period	Cross-sectional	Interview	*n* = 236	Pregnant women (3rd trimester)	Prescription and over-the-counter medications	59%	28.80%	N/A	N/A	71.20%
Mabina et al	1997	South Africa	Determine the prevalence of herbal medicine use during pregnancy	Cross-sectional	Interview with questionnaire	*n* = 577	Pregnant women (3rd trimester)	Herbal medicines	N/A	N/A	N/A	43.70%	43.70%
Vythilingum et al	2012	South Africa	Study the prevalence of substance use in an antenatal population	Cross-sectional	Self-report questionnaire	*n* = 323	Pregnant women (any trimester)	Recreational substances	N/A	N/A	4%	N/A	4%
Checa et al	2005	Spain	Assess the drug intake behaviour of immigrants during pregnancy	Cross-sectional	Interview with structured questionnaire and medical record review	*n* = 1103	Postpartum women	Prescription and over-the-counter medicines	N/A	N/A	N/A	N/A	74.60%
Falcon et al	2010	Spain	Investigate the prevalence of drug use in pregnancy and the relationship between drug exposure and induced abortions	Cross-sectional	Self-administered structured questionnaire and serum and hair testing	*n* = 142	Pregnant women (1st trimester)	Recreational drugs- cannabis, cocaine, opiates and MDMA (ecstasy)	N/A	N/A	30%	N/A	30%
Friguls et al	2012	Spain	Estimate the prevalence of drug use by pregnant women	Cross-sectional	Structured questionnaire and maternal hair analysis	*n* = 107	Postpartum women (1 day after delivery)	Cannabis, cocaine and MDMA	N/A	N/A	16%	N/A	16%
Garcia-Algar et al	2008	Spain	Assess the prevalence of gestational ethanol exposure in neonates	Cross-sectional	Meconium analysis and medical record review	*n* = 353	Postpartum women and neonates	Recreational drug- alcohol	N/A	N/A	45%	N/A	45%
Jimenez et al	1998	Spain	Determine drug use before pregnancy and in the early period of pregnancy	Cross-sectional	Interview with structured questionnaire	*n* = 272	Pregnant women (1st trimester)	Prescription and over-the-counter medications	N/A	N/A	N/A	N/A	62%
Joya et al	2012	Spain	Estimate the prevalence of illicit drug use among pregnant women	Cross-sectional	Structured questionnaire and maternal hair analysis	*n* = 347	Postpartum women (1 day after delivery)	Cocaine	N/A	N/A	2.60%	N/A	2.60%
Lendoiro et al	2013	Spain	Compare maternal interview and hair analysis to determine drug consumption throughout pregnancy and study relations among maternal interview, hair results, and neonatal outcomes	Cross-sectional	Interview with questionnaire and maternal hair analysis	*n* = 209	Postpartum women	Illicit drugs- cocaine, cannabis, opiates, methadone, and ketamine	N/A	N/A	15.40%	N/A	15.40%
Lozano et al	2007	Spain	Investigate the prevalence of in utero exposure of neonates to cannabis	Cross-sectional	Structured interview and meconium analysis	*n* = 974	Postpartum women and neonates	Recreational drug- cannabis	N/A	N/A	5.30%	N/A	5.30%
Martinez-Crespo et al	1994	Spain	Determine the prevalence of cocaine abuse during pregnancy	Cross-sectional	Self-completed structured questionnaire and urine toxicology	*n* = 1773	Postpartum women (immediately after delivery)	Recreational drug- cocaine	N/A	N/A	18.20%	N/A	18.20%

Table 2 Geographical distribution of the articles (continued)

Pichini et al	2005	Spain	Estimate the prevalence of drug use by pregnant women and the effects on the mother, fetus and infant	Prospective cohort study	Structured interview and meconium analysis	*n* = 1151	Pregnant women (any trimester) and neonates	Recreational drugs- opiates, cocaine, MDMA and arecoline	N/A	N/A	7.90%	N/A	7.90%
Holst et al	2008	Sweden	Study the characteristics of women using herbal drugs and impact of use in early pregnancy on pregnancy outcome	Retrospective cohort study	Medical birth registry	*n* = 860 215	Pregnant women (1st trimester)	Herbal drugs- Floradix, ginseng and valerian	N/A	N/A	N/A	0.90%	0.90%
Stephansson et al	2011	Sweden	Study drug use during pregnancy and agreement between antenatal records and dispensed drugs from pharmacy database	Retrospective cohort study	Medical birth register and Prescribed drug register	*n* = 102 995	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medicines	57.60%	N/A	N/A	N/A	57.60%
Chuang et al	2007	Taiwan	Investigate the prevalence of Chinese herbal medicines use by pregnant women	Cross-sectional	Interview with structured questionnaire	*n* = 1783	Postpartum women (6 months after delivery)	Chinese herbal medicines- An-Tai-Yin, pearl powder, huanglian, szu-wu-tang and ginseng	N/A	N/A	N/A	24.10%	24.10%
Chuang et al	2009	Taiwan	Investigate the use of Chinese herbal medicines during pregnancy and the postpartum period	Cross-sectional	Interview using structured questionnaire	*n* = 21 248	Postpartum women (6 months after delivery)	Chinese herbal medicines- An-Tai-Yin, pearl powder, huanglian, szu-wu-tang and ginseng	N/A	N/A	N/A	33.60%	33.60%
Chuang et al	2006	Taiwan	Investigate herbal medicine use during pregnancy and major congenital malformations	Prospective cohort study	Interview using structured questionnaire	*n* = 14 551	Pregnant women (3rd trimester)	Herbal medicines- An-Tai-Yin, huanglian and ginseng	N/A	N/A	N/A	16.90%	16.90%
Yeh et al	2009	Taiwan	Investigate the patterns of traditional Chinese medicine use among pregnant women	Retrospective cohort study	Health Insurance database	*n* = 196 350	Pregnant women (1st, 2nd and 3rd trimesters)	Traditional Chinese medicine	N/A	N/A	N/A	20.90%	20.90%
Massele et al	1997	Tanzania	Determine the use of antimalarial drugs during pregnancy	Prospective cohort study	Interview with structured questionnaire and antenatal card review	*n* = 200	Pregnant women (2nd trimester)	Prescription medications- antimalarials	75%	N/A	N/A	N/A	75%
Bakker et al	2006	The Netherlands	Investigate presription of drugs in women before, during and after pregnancy	Retrospective cohort study	Pharmacy database	n = 5412	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medications	N/A	N/A	N/A	N/A	79.10%
Ververs et al	2006	The Netherlands	Determine the extent and patterns of antidepressant use before, during and after pregnancy	Retrospective cohort study	Health care records and prescription database	*n* = 29 005	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medications- antidepressants	1.90%	N/A	N/A	N/A	1.90%
Uncu et al	2005	Turkey	Evaluate maternal and paternal smoking habits during pregnancy and their correlation with pregnancy complications and newborn status	Cross-sectional	Face-to-face interview using questionnaire	*n* = 499	Postpartum women	Recreational drug- cigarette	N/A	N/A	9.80%	N/A	9.80%

Table 2 Geographical distribution of the articles (continued)

Bishop et al	2011	United Kingdom	Report the frequency of complementary and alternative medicine use by a population of pregnant women	Prospective cohort study	Self-completed postal questionnaire	*n* = 14 115	Pregnant women (1st, 2nd and 3rd trimesters)	Complementary and alternative medicines	N/A	N/A	N/A	26.70%	26.70%
Fergusson et al	2002	United Kingdom	Determine the prevalence of cannabis use in pregnancy, the association between its use and lifestyle factors and assessment of its effects on pregnancy outcome	Prospective cohort study	Self-completed postal questionnaire	*n* = 12 129	Pregnant women (2nd trimester)	Cannabis	N/A	N/A	2.30%	N/A	2.30%
Forfar and Nelson	1973	United Kingdom	Investigate the drugs taken by pregnant women and those that may affect the fetus adversely	Cross-sectional	Structured interview and medical record review	*n* = 911	Postpartum women (shortly after delivery)	Prescription medications; Recreational drug- cigarette	82%	N/A	57%	N/A	N/A
Hall and Jolly	2013	United Kingdom	Determine the prevalence of women's use of complementary and alternative medicines during pregnancy and reasons for use	Cross-sectional	Interview with questionnaire	*n* = 315	Postpartum women	Complementary and alternative medicines	N/A	N/A	N/A	57.10%	57.10%
Headley et al	2004	United Kingdom	Investigate the prevalence of use of all types of medicinal products in pregnancy	Prospective cohort study	Self-completed postal questionnaire	*n* = 11 545	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription, over-the-counter, herbal and homeopathic products and other supplements	N/A	N/A	N/A	N/A	92.40%
Holst et al	2009	United Kingdom	Describe the use and user of herbal remedies during pregnancy and to study sources of information about herbs used	Cross-sectional	Self-administered questionnaire	*n* = 578	Pregnant women (2nd or 3rd trimester)	Herbal remedies- ginger, cranberry, raspberry leaf, chamomile, echinacea, peppermint, lavender, fennel, nettle and Floradix® (iron-rich herbs)	N/A	N/A	N/A	57.80%	57.80%
Irvine et al	2010	United Kingdom	Investigate the patterns of prescribing of drugs to women who gave birth in Scotland	Retrospective cohort study	Maternity records and Prescription database	*n* = 3937	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription drugs	85.20%	N/A	N/A	N/A	85.20%
Rubin et al	1986	United Kingdom	Investigate the use of therapeutic drugs, alcohol and cigarettes during pregnancy	Prospective cohort study	Self-administered questionnaire	*n* = 2765	Pregnant women (1st, 2nd and 3rd trimesters)	Therapeutic drugs, alcohol and cigarettes	N/A	N/A	N/A	N/A	34.80%
Andrade et al	2008	United States of America	Provide information on the prevalence of use of cardiovascular drugs among pregnant women	Retrospective cohort study	Databases	*n* = 118 935	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medicines- antihypertensives and antihyperlipidemics	3.20%	N/A	N/A	N/A	3.20%
Andrade et al	2004	United States of America	Provide information on the prevalence of use of prescription drugs among pregnant women	Retrospective cohort study	Databases	*n* = 152 531	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription medicines	64%	N/A	N/A	N/A	64%
Bauer et al	2002	United States of America	Determine the effects of exposure to illicit drugs during pregnancy on the mother, fetus and infant	Cross-sectional	Interview with questionnaire and meconium analysis	*n* = 1185	Postpartum women and neonates (within 7 days of delivery)	Recreational drugs- cocaine, opiate, alcohol, tobacco and marijuana	N/A	N/A	13%	N/A	13%

Table 2 Geographical distribution of the articles (continued)

Bercaw et al	2010	United States of America	Investigate the prevalence, reasons for use and physician-patient level of communication about the use of herbs, vitamins, over-the-counter and prescription medications in pregnancy	Cross-sectional	Self-administered questionnaire	*n* = 485	Postpartum women (immediately after delivery)	Herbs, vitamin supplements, over-the-counter medications and prescription medicines	29%	23%	N/A	19%	N/A
Buchi et al	1993	United States of America	Determine the prevalence of substance abuse among pregnant women	Cross-sectional	Urine analysis	*n* = 792	Pregnant women (3rd trimester)	Recreational drugs- marijuana, cocaine, amphetamines and alcohol	N/A	N/A	7.80%	N/A	7.80%
Buitendijk and Bracken	1991	United States of America	Assess medication use in a population of pregnant women	Cross-sectional	Interview	*n* = 4186	Pregnant women (1st trimester)	Prescription and over-the-counter medications	27.30%	54.90%	N/A	N/A	66%
Chang et al	2011	United States of America	Describe the prevalence and factors associated with self-reported substance use in young pregnant women	Cross-sectional	Mail survey and diagnostic interview	*n* = 30	Pregnant young adults (2nd trimester)	Alcohol and marijuana	N/A	N/A	33.30%	N/A	33.30%
Chasnoff et al	2005	United States of America	Determine the prevalence of substance use among pregnant women	Cross-sectional	Questionnaire and structured clinical interview	*n* = 4865	Pregnant women	Illicit drugs- marijuana, heroin,cocaine and methamphetamines	N/A	N/A	9%	N/A	9%
Chasnoff et al	1990	United States of America	Estimate the prevalence of substance abuse by pregnant women	Cross-sectional	Urine toxicology and medical record review	*n* = 715	Pregnant women	Recreational drugs- alcohol, cannabis, cocaine and opiates	N/A	N/A	14.80%	N/A	14.80%
Ebrahim and Gfroerer	2003	United States of America	Estimate the national prevalence of pregnancy-related illicit drug use and abstinence rates	Cross-sectional	Interview	*n* = 1249	Pregnant women (any trimester)	Marijuana/hashish, cocaine/crack, inhalants, hallucinogens and heroin	N/A	N/A	2.80%	N/A	2.80%
Frank et al	1988	United States of America	Assess cocaine use during pregnancy	Prospective cohort study	Interview, urine toxicology and medical record review	*n* = 679	Pregnant women	Recreational drug- cocaine	N/A	N/A	17%	N/A	17%
Gardiner et al	2013	United States of America	Determine the prevalence of herb and vitamin use in a population of underserved postpartum women and types of herbs used	Cross-sectional	Interview with questionnaire and medical chart review	*n* = 160	Postpartum women	Herbal medicines and vitamins	N/A	65%	N/A	39%	N/A
Gilchrist et al	1996	United States of America	Investigate the substance use patterns of adolescent mothers	Prospective cohort study	Face-to-face interview and urine analysis	*n* = 229	Pregnant adolescents	Recreational drugs- cigarette, alcohol, marijuana, crack, cocaine, psychedelics, heroin, opium, amphetamines, barbiturates, tranquilizers and inhalants (such as sniffing glue, gasoline, etc)	N/A	N/A	16%	N/A	16%

Table 2 Geographical distribution of the articles (continued)

Glover et al	2003	United States of America	Identify the medications that are used by a rural obstetric population	Prospective cohort study	Interview	*n* = 578	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription, over-the-counter and herbal medicines	95.80%	92.60%	N/A	45.20%	N/A
Golden et al	1984	United States of America	Determine the extent of phencyclidine use during pregnancy	Prospective cohort study	Interview with questionnaire and urine analysis	*n* = 2327	Pregnant women (1st, 2nd and 3rd trimesters)	Recreational drug-phencyclidine	N/A	N/A	0.80%	N/A	0.80%
Gray et al	2009	United States of America	Determine prenatal amphetamine, methamphetamine and ecstasy use	Cross-sectional	Interview and meconium analysis	*n* = 3705	Postpartum women and neonates (shortly after delivery)	Amphetamine, methamphetamine and ecstasy	N/A	N/A	5.50%	N/A	5.50%
Harrison and Sidebottom	2009	United States of America	Examine alcohol and drug use before and during pregnancy and to identify the predictors of use cessation	Prospective cohort study	Structured clinical interview	*n* = 1492	Pregnant women (1st trimester)	Recreational drug- alcohol	N/A	N/A	5.60%	N/A	5.60%
Havens et al	2009	United States of America	Examine the prevalence and correlates of substance use during pregnancy	Cross-sectional	Computer-assisted self-interview	*n* = 1800	Pregnant women (any trimester)	Recreational drugs- alcohol, cigarettes, marijuana, prescription analgesics, tranquilizers, sedatives and stimulants, cocaine, crack, heroin and methamphetamine	N/A	N/A	25.80%	N/A	25.80%
Hayes et al	2002	United States of America	Examine prenatal alcohol intake in a rural, caucasian clinic	Cross-sectional	Medical record review	*n* = 212	Pregnant women (1st trimester)	Recreational drug- alcohol	N/A	N/A	30%	N/A	30%
Hepner et al	2002	United States of America	Determine the prevalence and pattern of use of herbal and over-the-counter medicines in pregnancy	Cross-sectional	Self-completed postal questionnaire	*n* = 734	Pregnant women (2nd trimester)	Herbal remedies (echinacea, St. John's wort and ephedra) and over-the-counter medications (cold remedies, pain relievers and heartburn medications)	N/A	75.60%	N/A	7.10%	N/A
Kokotailo et al	1992	United States of America	Determine the prevalence and associated risk factors of cigarette, alcohol and other drug use among school-age pregnant adolescents	Prospective cohort study	Self-administered questionnaire, urine and breathe sample analyses and medical record review	*n* = 212	Pregnant adolescents	Cigarette, Alcohol and Other drugs (marijuana, heroin, cocaine, cannabis, opiates, benzodiazepines and prescription pain killers)	N/A	N/A	17%	N/A	17%

Table 2 Geographical distribution of the articles (continued)

Kokotailo et al	1994	United States of America	Determine the prevalence of cigarette, alcohol and other drug use among small-city pregnant adolescents	Prospective cohort study	Self-administered questionnaire, urine toxicology and medical record review	*n* = 117	Pregnant adolescents	Recreational drugs- cigarette, alcohol and illicit drugs (amphetamines, benzodiazepines, cannabis, cocaine, opiates, phencyclidine and lysergic acid diethylamide	N/A	N/A	35%	N/A	35%
Kratz and Vaughan	2012	United States of America	Examine the predictors of cigarette use in pregnant women	Cross-sectional	Computer-assisted in-home interview	*n* = 1782	Pregnant women (2nd or 3rd trimester)	Cigarette	N/A	N/A	18.90%	N/A	18.90%
Lester et al	2001	United States of America	Describe drug use by pregnant women	Cross-sectional	Structured interview and meconium toxicology	*n* = 11 811	Postpartum women and neonates (shortly after delivery)	Recreational drugs- cocaine and opiate	N/A	N/A	10.70%	N/A	10.70%
Li et al	2003	United States of America	Evaluate prenatal use of non-steroidal anti-inflammatory drugs (NSAIDS), aspirin and paracetamol and its association with increased risk of miscarriage	Prospective cohort study	In-person interview	*n* = 1055	Pregnant women (1st trimester)	Over-the-counter medications- NSAIDS, aspirin and paracetamol	N/A	5%	N/A	N/A	5%
Marcus and Flynn	2008	United States of America	Describe the prenatal patterns of antidepressant use and their relationship to depression in pregnancy	Cross-sectional	Structured clinical interview	*n* = 276	High risk pregnant women (2nd or 3rd trimester)	Prescription medications- antidepressants	13%	N/A	N/A	N/A	13%
Ostrea et al	1992	United States of America	Determine the prevalence and epidemiologic characteristics of drug use in a high-risk, urban obstetric population	Cross-sectional	Meconium analysis and medical record review	*n* = 3010	Postpartum women and neonates	Recreational drugs- cocaine, morphine and cannabis	N/A	N/A	44%	N/A	44%
Perham-Hester and Gessner	1997	United States of America	Examine the characteristics related to drinking during pregnancy	Cross-sectional	Self-completed postal questionnaire	*n* = 6973	Postpartum women (2 to 8 months after delivery)	Recreational drug- alcohol	N/A	N/A	9.20%	N/A	9.20%
Refuerzo et al	2005	United States of America	Determine the frequency of prescription, over-the-counter and herbal medicines use by pregnant women	Cross-sectional	Self-completed questionnaire	*n* = 418	Postpartum women	Prescription, over-the-counter and herbal medicines	76.50%	62.80%	N/A	4.10%	96.90%
Riley et al	2005	United States of America	Determine the correlates of prescription drug use during pregnancy	Prospective cohort study	Telephone survey and medical record review	*n* = 1626	Pregnant women	Prescription drugs- antibiotics, analgesics, asthma medications and antiemetics	56%	N/A	N/A	N/A	56%

Table 2 Geographical distribution of the articles (continued)

Santiago et al	2013	United States of America	Describe maternal intake of food, drink, and medication during pregnancy	Cross-sectional	Self-completed questionnaire	*n* = 200	Pregnant women (3rd trimester) and Postpartum women (8 weeks after delivery)	Over-the-counter medicines and alcohol	N/A	28.90%	5.80%	N/A	N/A
Schempf and Strobino	2008	United States of America	Examine the association between adverse birth outcomes and drug use in pregnancy	Cross-sectional	Interview with questionnaire, medical record review and urine toxicology	*n* = 808	Postpartum women	Recreational drugs- cocaine, opiates, marijuana, cigarette and alcohol	N/A	N/A	25%	N/A	25%
Splinter et al	1997	United States of America	Determine overall medication use by prenatal patients	Cross-sectional	Personal interview and medical record review	*n* = 100	Postpartum women (within 4 days of delivery)	Prescription and over-the-counter medications	93%	94%	N/A	N/A	N/A
Teagle and Brindis	1998	United States of America	Investigate substance use among pregnant adolescents and to compare self-reported use and provider perception	Cross-sectional	In-person interview and self-administered questionnaire	*n* = 248	Pregnant adolescents (1st trimester)	Substance use- cigarette, alcohol, marijuana, cocaine and crack	N/A	N/A	49%	N/A	49%
van Gelder et al	2010	United States of America	Determine the prevalence of self-reported illicit drug use during pregnancy and its association with demographic and social factors	Cross-sectional	Telephone interview	*n* = 5871	Postpartum women (between 6 weeks and 24 months after delivery)	Recreational drugs- cannabis, cocaine and stimulants	N/A	N/A	3.60%	N/A	3.60%
Vega et al	1993	United States of America	Identify the prevalence and demographic profiles associated with substance use during pregnancy	Cross-sectional	Urine analysis	*n* = 29 494	Postpartum women	Recreational drugs- amphetamines, barbiturates, benzodiazepines, cannabis, cocaine, methadone, opiates, phencyclidine and alcohol	N/A	N/A	11.35%	N/A	11.35%
Mureyi et al	2012	Zimbabwe	Determine the prevalence of prenatal use of traditional medicine within a sample of women	Cross-sectional	Interview with questionnaire	*n* = 248	Postpartum women (6 weeks after delivery)	Traditional medicines	N/A	N/A	N/A	52%	52%

1.2.5.2 Prevalence of medicine and recreational substance use

The papers reviewed reported between 1.5% (Larivaara et al., 1996) and 96.4% (Egen-Lappe and Hasford 2004) for the prevalence of use of prescription medicines in pregnancy. Over-the-counter medicines had the prevalence which ranged between 5% (Li et al., 2003) and 94% (Splinter et al., 1997). The prevalence of recreational substance use in pregnancy as reported varied from 0.3% (Bessa et al., 2010) to 94% (Senn et al., 2009). Complementary and alternative medicines use had a prevalence which ranged from 0.58% (Cleary et al., 2010) to 90.3% (Malan and Neuba 2011). The overall prevalence of medicine and recreational substance use in pregnancy as reported by all the studies ranged from 0.3% (Bessa et al., 2010) to 99.5% (Berthier et al., 1993). Table 3 shows the range of values reported in the articles.

Table 3 Prevalence of medicine and substance use in pregnancy

Medicine/Substance	Prevalence % (range of values)
Prescription medicines	1.5 – 96.4
Over-the-counter medicines	5 – 94
Recreational substances	0.3 – 94
Complementary and alternative medicines	0.58 – 90.3
Overall prevalence	0.3 – 99.5

1.2.6 Discussion

1.2.6.1 Methodological issues

Research focusing on the use of medicines and recreational substances during pregnancy has been reported from different parts of the world. However, it is difficult to compare the prevalence of use of these agents in different populations based on the relevant literature for several reasons: the articles studied different categories of medicine or recreational substance exposures while focusing on different time periods of pregnancy or postpartum; patterns of medicine or recreational substance use differ according to countries and the social and cultural characteristics of their pregnant women; and the differences in research methodology led to great variations in the completeness of antenatal medicine and substance exposure data.

In terms of the study designs, 89 of the papers employed the cross-sectional study designs, 25 carried out prospective studies while 18 of the studies were done retrospectively.

The sample sizes of the studies reviewed varied from 30 (Chang et al., 2011) to 860,215 (Holst et al., 2008) which also makes the comparison of results difficult.

The participants involved in the studies included pregnant women at different stages of gestation, postpartum women at different times after delivery as well as neonates. Eighty-seven of the papers recruited pregnant women, one study (Pichini et al., 2005) involved pregnant women and subsequently their neonates, 36 papers recruited postpartum women, 7 papers involved

postpartum women and neonates while Mashayekhi et al. (2009) and Santiago et al. (2013) were the two studies which recruited both pregnant and postpartum women as participants.

The data collection methods used by the studies varied from questionnaires (which could be self-administered, postal, internet, structured or semi-structured) clinical interviews, birth registries, health care records, prescription databases, computer-assisted self-interviews and telephone surveys to urine, hair, meconium, serum and breathe analyses. Hence, a significant challenge when interpreting the literature results from variation in data collection methods. Most studies employed self-administered questionnaires (e.g. Forster et al., 2006); interviews using various tools (e.g. Chuang et al., 2009) or information from databases (e.g. Andrade et al., 2004) while a few others carried out analyses of urine, meconium, hair, serum or breathe samples (e.g. Martinez-Crespo et al., 1994). Two studies (Havens et al., 2009; Kratz and Vaughan 2012) employed the computer-assisted self-interview method. Each data collection method has strengths and limitations which need to be considered when interpreting the results of the studies.

Self-administered questionnaires are a relatively quick method of collecting information from a large group in a standardised way. However, there is no capacity to clarify confusion and they are limited by the participants' knowledge of the subject matter and their willingness to recall and report use.

Interviewing allows the researcher to adapt questions as necessary and to ensure that they are properly understood. Although this method requires significant resources, it was reported by Kelsey et al., (1996) that data from interviewer-administered questionnaires provide more reliable and complete information than self-administered questionnaires, the latter methodology being often associated with a lower adhesion by potential participants and inappropriate compilation and misinterpretation of the answers.

The use of the internet questionnaire as an efficient way of collecting population-based data is limited by the fact that not all potential participants have access to the internet.

The analysis of prescription data is a cost-effective way to collect information on medicine use in pregnancy and has an added advantage of providing a large population-based sample for analysis. All prescriptions redeemed by the women are available and the relevant details on the prescribed medicines are given. These survey instruments also avoid the potential for maternal underreporting of medicine exposures due to recall bias but they have limitations. One of the major limitations of administrative pharmacy data is that they serve only as a proxy for exposure as they cannot ensure that medicines are actually consumed. They do not take into account non-compliance and therefore may not reflect what was actually used or ingested. For example, the EUROMAP Group noted that only 43% of dispensed prescription medicines were reported as being used by the pregnant women in their study (Olesen et al., 2001). Furthermore, it is possible that a dispensing during pregnancy might be meant for maternal use after delivery (e.g. contraceptive hormones dispensed during the third

trimester of pregnancy), leading to a possible overestimation of the burden of medicine use during pregnancy (Donati et al., 2000). Also, non-prescription medicines such as over-the-counter analgesics, herbal products and recreational substances are not captured in the database which contributes to a possible underestimate of risk exposure (Gagne et al., 2008). Another limitation of using databases is lack of data on the length of gestation; a 270-day gestational period is assumed. Therefore, it does not adequately address the timing of medicine exposure among women with preterm birth, considering the ambiguity in length of gestation for these women (Andrade et al., 2004).

All biological screening tests are expensive and some of them could be complicated to carry out. For example, the use of maternal or neonatal hair for assessment of recreational substance use is limited by the fact that coarse black hair incorporates more of the substance than brown or blonde hair, necessitating the need for differential scaling by hair colour (Ebrahim and Gfroerer, 2003).

Urine toxicology screens provide conservative estimates because they can detect only very recent substance use. Thus, the sensitivity of urine testing is constrained by the limited detection period for each substance. For example, alcohol can be detected in urine only if it had been consumed in the preceding 8-12 hours because of its rapid metabolism and excretion in the urine. This implies that the actual prevalence of use over the course of a pregnancy is likely to be underestimated (Frank et al., 1988; Chasnoff et al., 1990; Kokotailo et al., 1992; Buchi et al., 1993; Vega et al., 1993; Ebrahim and Gfroerer, 2003). Another limitation of using urine for drug testing is that it

does not provide information on the amount and frequency of substance use (Chasnoff et al., 1990; Bibb et al., 1995).

Blood or serum analysis can only detect acute use and must be repeated very often. Also, its sampling procedure is invasive and it is more difficult than urine to analyse because it contains proteins and other cellular constituents (Bibb et al., 1995; Lozano et al., 2007).

The efforts involved in collecting and conducting meconium analyses is high (Lozano et al., 2007). The timing of recreational substance exposure may also influence meconium toxicology results. Some women discontinue use before the third trimester and the results obtained from the meconium analysis of their neonates can be misleading. In the first trimester, meconium has not yet formed therefore substance use in early pregnancy may be poorly reflected in meconium (Gray et al., 2009). It was suggested by Ebrahim and Gfroerer (2003) and Gray et al. (2009) that maternal self-report is more rational and sensitive than meconium testing for identifying substance-exposed neonates.

The breathe sample test for expired carbon monoxide is a qualitative method of assessing cigarette smoking and is dependent on time of use. It is not highly sensitive and sporadic use of cigarettes can make it more difficult to use this objective screening method effectively (Kokotailo et al., 1992).

In the case of the computer-assisted self-interview, it has been discovered that some participants are more comfortable using this method. However, this only seemed to be feasible with middle class participants; it is very challenging to recruit where subjects are less familiar with computers.

Participants' refusal in the latter case are not usually linked to the topic of the research, but to the inability to use computers which could make them look naive (Boynton, 2004).

1.2.6.2 Medicines and recreational substances reported by the articles

The articles reported a wide range of medicines and recreational substances which are presented in Table 4 (some articles reported more than one medicine or recreational substance). Fifty-seven articles studied prescription medicines, 35 papers reported on over-the-counter medicines, 41 researched on complementary and alternative medicines while 52 articles studied recreational substances. The prescription medicines presented in the table have been grouped according to the World Health Organisation ATC (Anatomical Therapeutic Chemical) classification system.

The number of medicines or recreational substances (Prescription, Over-the-counter, Complementary and alternative medicines or Recreational substances) studied also varied across the articles reviewed. Most of the papers (69%) studied only one type of medicine or recreational substance (e.g. Hollyer et al., 2002; Chasnoff et al., 2005), some two types of medicines (e.g. Hepner et al., 2002), others studied three medicine types (e.g. Zhu et al., 2010) while only 3 articles (Cleary et al., 2010; Abasiubong et al., 2012; Ystrom et al., 2012) studied all the medicine types as well as recreational substances.

Table 4 Medicines and recreational substances reported by the articles

Prescription medicines	Over-the-counter medicines	Complementary and alternative medicines	Recreational substances
(A) Alimentary tract and metabolism Antacids, drugs for peptic ulcer and flatulence e.g. ranitidine. Antispasmodics, anticholinergics and propulsives e.g. dicyclomine + pyridoxine. Antiemetics and Antinauseants e.g. metoclopramide, doxylamine + pyridoxine, domperidone. Laxatives. Antidiarrhoeals, intestinal anti-inflammatory/anti-infectives.	Vitamins e.g. folic acid Mineral supplements Anti-anaemic preparations Analgesics/Antipyretics e.g. paracetamol Cough and cold preparations Antihistamines for systemic use Nasal preparations Antacids and drugs for flatulence.	Acupressure/seabands, acupuncture, alfalfa, almond oil, aloe, an-tai-yin, arnica, aromatherapy, autogenic training. Bach flowers, ban lan gen, bao tai ling, barley, bioresonance therapy, black elderberry, black powder, black soap, breathing exercises, burdock. CAM diets (e.g. vegetable carbon), chamomile, cocoa butter, cod liver oil, cranberry.	**Licit substances** Alcohol Tobacco Betel (Areca) nut (contains arecoline) **Illicit drugs** Amphetamine (AMP) Cannabis (also known as marijuana, hashish grass, ganja or Indian hemp) Cocaine/Crack

Table 4 Medicines and recreational substances reported by the articles (continued)

Drugs used in diabetes e.g. insulin.	Damascisa, devil's claw, digestive bitters.	Codeine
Vitamins		Drugs used without medical prescription e.g. barbiturates and benzodiazepines.
Mineral supplements	Echinacea, ephedra, essential oils.	
(B) Blood and blood forming organs	Fennel, flax, floradix (iron-rich herbs), fringed rue.	Heroin
Anti-anaemic preparations		Inhalants e.g. sniffing glue, gasoline.
(C) Cardiovascular system	Garden cress, garlic, ginger, ginkgo biloba, ginseng, golden seal, green tea.	Lysergic acid diethyl amide (LSD)
Vasoprotectives (anti-haemorrhoidals)		
Beta-blocking agents		
Calcium channel blockers	Herbal brew, herbal soup, herbal teas, homeopathy, horsetail, huang lien, huanglian.	Methylene dioxymethamphetamine (MDMA or ecstasy)
(D) Dermatologicals		
Antifungals		
Antipruritics		

Table 4 Medicines and recreational substances reported by the articles (continued)

Topical antibiotics.	Incantations, inoculations, iridology, isihlambezo.	Mescaline
Corticosteroids, topical.		
Antiseptics and disinfectants.		Methamphetamine (MAMP)
	Kava kava	
(G) Genito-urinary system and sex hormones		Morphine
	Lavender, lemon, licorice.	
Gynaecological anti-infectives and antiseptics.		Phencyclidine (PCP or angel dust)
Sex hormones, modulators of genital system e.g. oestrogen, progestogen,	Marcela, massage, mauve, melatonin, metabolife, miso paste.	
medroxyprogesterone.		Buprenorphine
	Naturopathy, nettle, niu huang jie du pian, noni juice.	Methadone
(H) Systemic hormones excluding sex hormones		
	Orthomolecular medicine	
Corticosteroids for systemic use.		
Thyroid therapy e.g. thyroxine.	Parsley, pearl powder, peppermint, phytotherapy,	

Table 4 Medicines and recreational substances reported by the articles (continued)

(J) Anti-infectives for systemic use	propolis, pumpkin.
Antibacterials e.g. amoxicillin, ampicillin, macrolides.	Raspberry leaf, revulsive balsam, rye ergot
(M) Musculo-skeletal system	Senna, shang ching pian,
Anti-inflammatory and antirheumatic products e.g. sulfasalazine, prednisolone.	slippery elm, sobe herbal drink, St. John's wort, szu-wu-tang.
	Valerian, vitamin B6
(N) Nervous system	
Analgesics	Waistbands rings & safety
Antiepileptics	pins, wheat germ oil, witch
Psycholeptics – benzodiazepines,	hazel.
antipsychotics.	Xenadrine, xiao chai hu tang.
Psychoanaleptics – antidepressants	Yinqiao, yoga.

Table 4 Medicines and recreational substances reported by the articles (continued)

(P) Anti-parasitics,
insecticides and repellents
Antiprotozoals e.g. chloroquine
(R) Respiratory system
Nasal preparations
Throat preparations
Anti-asthmatics
Cough and cold preparations
Antihistamines for systemic use
(S) Sensory organs
Ophthalmologicals
Otological products

1.2.6.3 Pregnancy Outcomes

Twenty-eight of the 132 papers reviewed gave information about the outcomes of the pregnancies but 19 of those found correlation between the medicines or recreational substances used and the pregnancy outcomes (Table 5). However of the 19 articles, 9 were prospective cohort studies (Correy et al., 1991; Larivaara et al., 1996; Fergusson et al., 2002; Li et al., 2003; Headley et al., 2004; Pichini et al., 2005; Chuang et al., 2006; Dal Pizzol et al., 2008; Hayatbakhsh et al., 2012) while others were cross-sectional studies.

With regard to the articles which found correlations, 4 reported on prescription medicines (Correy et al., 1991; Larivaara et al., 1996; Dal Pizzol et al., 2008; Rachidi et al., 2013), 3 articles studied over-the-counter medicines (Li et al., 2003; Headley et al., 2004; Rachidi et al., 2013), 4 articles provided information about complementary and alternative medicines (Opaneye, 1998; Chuang et al., 2006; Cuzzolin et al., 2010; Nordeng et al., 2011), 1 article was on alcohol (Schempf and Strobino, 2008), 5 articles reported on cigarette and arecoline (Pichini et al., 2005; Uncu et al., 2005; Schempf and Strobino, 2008; Senn et al., 2009; Rachidi et al., 2013), and 6 articles were about illicit substances (Ostrea et al., 1992; Bauer et al., 2002; Fergusson et al., 2002; Pichini et al., 2005; Hayatbakhsh et al., 2012; Lendoiro et al., 2013).

As documented in the articles, prescription medicine use during pregnancy was associated with hypospadias, phocomelia, pes cavus, syndactyly, clubfoot, meningomyelocele, microcephaly, fingernail defects, low birth weight, decreased apgar scores and medical complications of babies. Over-

the-counter medicine use was found to be associated with wheezing in early childhood (a long-term outcome of paracetamol use), increased risk of miscarriage, decreased apgar scores, increased risk of underweight babies and medical complications of babies. Complementary and alternative medicine use was associated with increased risk of congenital malformations of the nervous system, musculoskeletal, connective tissues and the eye, threatening miscarriages, preterm labour, cardiac malformation, enlarged kidney, uterine hyper-contractility, placenta previa, intrauterine growth restriction, small-for-gestational age babies, high birth weight, antepartum and postpartum haemorrhages, ruptured uterus and stillbirths.

Deceased apgar scores, low birth weight, medical complications of babies, preterm delivery, intrauterine growth retardation, prenatal death and hyporeflexia were found to be associated with alcohol, cigarette and arecoline (from areca nut) use. In the case of illicit substances, placental abruption, low birth weight, preterm labour, small-for-gestational age babies, admission to the neonatal intensive care unit, neonatal abstinence syndrome, smaller length and smaller head circumference were found to be associated with use.

Table 5 Pregnancy outcomes and correlation with medicines or recreational substances used

Author/Year	Medicines/Substances	Pregnancy outcomes	Correlation with medicines/substances used
Bauer et al., 2002	Cocaine and opiates	Maternal complications such as increased risk of syphilis, gonorrhoea, hepatitis and HIV infections as well as psychiatric, nervous and emotional disorders and placental abruption.	Yes
Berthier et al., 1993	Prescription and over-the-counter medications	Premature birth, stillbirth, lombo-sacral meningocele, sacral fistula, atrial and ventricular septal defects, bilateral cleft lip, preauricular fistula and polydactylia.	No

Table 5 Pregnancy outcomes and correlation with medicines or recreational substances used (continued)

Chuang et al., 2006	Huanglian	Increased risk of congenital malformation of the nervous system	Yes
	An-Tai-Yin	Increased risk of congenital malformations of the musculoskeletal and connective tissues and the eye	
Chuang et al., 2007	Chinese herbal medicines	Low birth weight, preterm delivery and congenital malformations	No
Correy et al., 1991	Aspirin Dicyclomine Oral contraceptive	Hypospadias Phocomelia Pes cavus (significance level of these associations was considered marginal)	Yes

Table 5 Pregnancy outcomes and correlation with medicines or recreational substances used (continued)

Cuzzolin et al., 2010	Chamomile and Licorice	Threatening miscarriages and preterm labour.	Yes
	Chamomile	Cardiac malformation and enlarged kidney.	
	Ginger	Uterine hyper-contractility and placenta previa.	
	Echinacea	Intrauterine growth restriction. All the herbals caused small-for-gestational age babies.	
Dal Pizzol et al., 2008	Misoprostol	Syndactyly, clubfoot, meningomyelocele, microcephaly and fingernail defects.	Yes
Dal Pizzol et al., 2009	Dipyrone	Clubfoot, syndactyly, polydactyly, choanal atresia, anencephaly, macrocephaly,	No

Table 5 Pregnancy outcomes and correlation with medicines or recreational substances used (continued)

		meningomyelocele, abducted fourth and fifth left foot fingers, intrauterine death, preterm birth and low birth weight.	
Durisova and Magulova 2004	Prescription and over-the-counter medications	Premature birth, neonatal sepsis, cheilognatopalatoschisis, vitium cordis congenitum.	No
Fergusson et al., 2002	Cannabis	Low birth weight	Yes
Friguls et al., 2012	Cannabis, cocaine and MDMA	Foetal acid-base status, Apgar scores, hypoglycaemia events.	No
Hayatbakhsh et al., 2012	Cannabis	Low birth weight, preterm labour, small-for-gestational age, admission to the neonatal	Yes

Table 5 Pregnancy outcomes and correlation with medicines or recreational substances used (continued)

		intensive care unit.	
Headley et al., 2004	Paracetamol	Wheezing in early childhood (a long-term outcome)	Yes
Joya et al., 2012	Cocaine	Low birth weight, low crown-heel length, low cranial perimeter.	No
Kulaga et al., 2009	Prescription medicines	Miscarriage and major congenital malformations	No
Lacroix et al., 2009	Prescription medicines	Malformations of the central nervous system, cardiovascular system, urinary tract, musculo-skeletal system, intrauterine growth retardation and genetic abnormality.	No

Table 5 Pregnancy outcomes and correlation with medicines or recreational substances used (continued)

Larivaara et al., 1996	Psychotropic drugs (tranquilisers, hypnotics and antidepressants)	Low birth weight	Yes
Lendoiro et al., 2013	Methadone and cocaine	Neonatal abstinence syndrome	Yes
Li et al., 2003	NSAIDs and Aspirin	Increased risk of miscarriage	Yes
Nordeng et al., 2011	Iron-rich herbs	High birth weight	Yes
Opaneye, 1998	Traditional medicines	Maternal morbidity and mortality- hypertensive diseases, antepartum and postpartum haemorrhages, ruptured uterus, cervical tear and maternal death; Stillbirths.	Yes

Table 5 Pregnancy outcomes and correlation with medicines or recreational substances used (continued)

Ostrea et al., 1992	Cocaine	Premature neonates, small-for-gestational age, low birth weight, smaller length and smaller head circumference.	Yes
	Morphine	Low birth weight, smaller length and smaller head circumference.	
	Cannabis	Low birth weight, smaller length and smaller head circumference.	
Pichini et al., 2005	Opiates and Cocaine	Low birth weight and crown-heel length.	Yes
	Arecoline (from areca nut)	Low birth weight, low intrauterine growth, hyporeflexia, hypotonia and neonatal abstinence syndrome.	

Table 5 Pregnancy outcomes and correlation with medicines or recreational substances used (continued)

Rachidi et al., 2013	Prescription, over-the-counter medicines and cigarettes	Decreased Apgar scores, increased risk of underweight babies and medical complications of babies.	Yes
Schempf and Strobino 2008	Cigarette and alcohol (heavy smoking and drinking)	Low birth weight	Yes
Senn et al., 2009	Betel (areca) nut	Low birth weight	Yes
Uncu et al., 2005	Cigarette	Low birth weight, preterm delivery, intrauterine growth retardation and prenatal death.	Yes
Van Gelder et al., 2010	Illicit drugs- cannabis, cocaine and stimulants	Low birth weight and preterm birth.	No

1.2.6.4 Implications for this thesis

The differences in contexts, times and methods, and different variables taken into account in each study suggest the need for further research. Eighty-six of the 132 articles covered in this narrative review were published in the last 10 years, and this trend is in line with a growing interest in the use of medicines and recreational substances in general. Nevertheless, the narrative review has identified some gaps in the scientific literature.

First, most of the studies (n = 89) were cross-sectional while others were cohort studies. Although both cross-sectional and cohort studies give the prevalence of medicine and recreational substance use, it is also important to recognise the medicines and recreational substances used during each of the three trimesters of pregnancy and the pregnancy outcomes. Furthermore, because the first trimester has been noted to be the period of greatest risk to the foetus if medicines or substances are taken (Porter, 2004), it is crucial to examine the association between medicine or recreational substance use during this period and the pregnancy outcomes. Hence cohort studies are necessary in these contexts. However, of the 19 articles which reported associations between the medicines or recreational substances used and the pregnancy outcomes, 9 were prospective cohort studies (section 1.2.6.3) and only Headley et al. (2004) recruited pregnant women in the first trimester and did a follow up in the second and third trimesters up to the pregnancy outcomes. In addition, only 2 of the 9 prospective cohort studies (Correy et al., 1991; Li et al., 2003) considered first trimester use of medicines and pregnancy outcomes.

Therefore, in addition to learning about the prevalence of use of medicines and recreational substances in pregnancy, researchers also need to understand the changes in types of product or therapy used during the three trimesters of pregnancy and how the products relate to pregnancy outcomes. The effects of multiple medicines or substances on pregnancy outcomes would also be informative to healthcare professionals. Chuang et al. (2006) therefore concluded that prospective exposure data collection during pregnancy, before the outcome of pregnancy, remains the best method of gathering reliable data on medicine and recreational substance use during pregnancy.

A second issue relate to when the information was collected during the study, which could be either during the gestational or postpartum period. One hundred and nineteen of the 132 studies involved data collection in the mid- or late pregnancy or postpartum period. This could have led to under-reporting of medicine or recreational substance use due to the unreliability of recall. For example, Moussally et al. (2009) relied on women's memories of herbal medicine use three to eight years after the pregnancy of interest. Therefore, recall bias may be a significant limitation in the survey and this might have affected the results obtained.

Third, while 69% of the articles studied one type of medicine or substance (section 1.2.6.2), only 3 articles (Cleary et al., 2010; Abasiubong et al., 2012; Ystrom et al., 2012) reported on all the medicines and recreational substances of interest (prescription, over-the-counter, complementary and alternative medicines and recreational substances). These studies were cross-sectional; hence, there is a need for research of this type to be carried

out longitudinally in order to identify those medicines and substances which are most commonly used and to highlight where further research into safety might appropriately be pursued.

Another important point is that further research is still needed to develop the evidence base for the use of complementary and alternative therapies especially because of the safety issues related to their use in gestation.

Lastly, although the 132 studies reviewed examined the use of medicines and recreational substances in a wide range of countries, it is necessary to investigate medicine and recreational substance use during pregnancy within a large ethnically diverse metropolitan city such as London, United Kingdom. This narrative review has identified 6 published studies on medicine and recreational substance use in pregnancy in the UK in the last 15 years (Table 6). Irvine et al. (2010) reported the prevalence of prescription medicines using the prescription database and maternity records. As discussed earlier (section 1.2.6.1), the use of databases and records have several limitations which might have affected the results of the study. Two studies (Holst et al., 2009a; Hall and Jolly, 2013) investigated the use of complementary and alternative remedies in pregnancy. They were cross-sectional studies carried out with questionnaires and the participants were not followed up to the pregnancy outcomes. Three other studies - Fergusson et al., 2002; Headley et al., 2004; Bishop et al., 2011- presented data on self-reported use of medicines and recreational substances in pregnancy in the UK. These studies were carried out in 1991-1992; they relate to pregnancies over 20 years ago and may have little relevance to the current situation of pregnant women in the UK. Therefore, it is important to update the existing knowledge

of medicine and recreational substance use during pregnancy in the United Kingdom.

Table 6 Studies carried out within the United Kingdom in the last fifteen years

Author	*Year of study*	*Country*	*Objectives of the study*	*Methods*		*Population characteristics*		*Type of medicine or substance studied*	*Prevalence of use*				
				Study design	*Data collection*	*Sample size*	*Study participants*		*Prescription medicines*	*Over-the-counter medications*	*Recreational drugs or substances*	*Complementary & alternative medicines*	*Overall*
Fergusson et al	2002	United Kingdom	Determine the prevalence of cannabis use in pregnancy, the association between its use and lifestyle factors and assessment of its effects on pregnancy outcome	Prospective cohort study	Self-completed postal questionnaire	*n* = 12 129	Pregnant women (2nd trimester)	Cannabis	N/A	N/A	2.30%	N/A	2.30%
Headley et al	2004	United Kingdom	Investigate the prevalence of use of all types of medicinal products in pregnancy	Prospective cohort study	Self-completed postal questionnaire	*n* = 11 545	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription, over-the-counter, herbal and homeopathic products and other supplements	N/A	N/A	N/A	N/A	92.40%
Holst et al	2009	United Kingdom	Describe the use and user of herbal remedies during pregnancy and to study sources of information about herbs used	Cross-sectional	Self-administered questionnaire	*n* = 578	Pregnant women (2nd or 3rd trimester)	Herbal remedies-ginger, cranberry, raspberry leaf, chamomile, echinacea, peppermint, lavender, fennel, nettle and Floradix® (iron-rich herbs)	N/A	N/A	N/A	57.80%	57.80%
Irvine et al	2010	United Kingdom	Investigate the patterns of prescribing of drugs to women who gave birth in Scotland	Retrospective cohort study	Maternity records and Prescription database	*n* = 3937	Pregnant women (1st, 2nd and 3rd trimesters)	Prescription drugs	85.20%	N/A	N/A	N/A	85.20%
Bishop et al	2011	United Kingdom	Report the frequency of complementary and alternative medicine use by a population of pregnant women	Prospective cohort study	Self-completed postal questionnaire	*n* = 14 115	Pregnant women (1st, 2nd and 3rd trimesters)	Complementary and alternative medicines	N/A	N/A	N/A	26.70%	26.70%
Hall and Jolly	2013	United Kingdom	Determine the prevalence of women's use of complementary and alternative medicines during pregnancy and reasons for use	Cross-sectional	Interview with questionnaire	*n* = 315	Postpartum women	Complementary and alternative medicines	N/A	N/A	N/A	57.10%	57.10%

1.2.7 Summary

Pregnant women are typically considered a special group and frequently excluded from pre-approval medicine studies. Consequently, the safety of medicines in this population is largely unknown prior to experience gained through widespread use. There are few data available on the full extent of medicine use during pregnancy including prescription, over-the-counter and complementary and alternative medicines as well as recreational substances and their effects on pregnancy outcomes. There is therefore, the need for further research on the subject matter. Cohort studies, with their prospective exposure assessment and the ability to monitor both adverse and beneficial foetal outcomes, seem to be the most promising study type from a methodological viewpoint. This will be explored in the next chapter which is a prospective cohort study of the epidemiology of medicine and recreational substance use amongst pregnant women in London.

CHAPTER 2 - PRENATAL USE OF MEDICINES AND RECREATIONAL SUBSTANCES: PREVALENCE, PREGNANCY OUTCOMES AND MOTHERS' SAFETY KNOWLEDGE

2.1 Introduction

Prescription medicine use in pregnancy is common (Hardy et al., 2006; Mehta and Larson, 2011). In addition to prescribed medicines, many women also take over-the-counter, complementary and alternative medicines and recreational substances during their pregnancy which could pose a risk to the developing baby (Shehata and Nelson-Piercy, 2001; Conover, 2003; Andrade et al., 2004; Schempf, 2007). The investigation of the effects of medicines and recreational substances on foetal development can take the form of case reports or epidemiologically based cohort and case-control studies. The most common are cohort studies and if there is no increase in the incidence of birth defects associated with a particular medicine, researchers will often conclude that the medicine is 'safe' in pregnancy (Webster and Freeman, 2003).

There is limited information available on the use of medicines and recreational substances during pregnancy within the UK in the last fifteen years. A survey of 256 women attending the EPAU (Emergency Pregnancy Assessment Unit) at Guy's and St. Thomas' Hospital carried out in 1998 found that 26% of the women had taken prescription medicines, 56% had taken over-the-counter medicines, 26% had used a recreational substance, most frequently cannabis while 5% had used complementary therapies during their pregnancy (Dines et al., 2005).

Some studies have revealed associations between the use of medicines or recreational substances during pregnancy and adverse pregnancy outcomes (Ostrea et al., 1992; Chuang et al., 2006); this issue is complicated by the fact that the safety profile of a given medicine often changes during the

course of a normal pregnancy (Black and Hill, 2003). Thus Koren (2002) pointed out that the best way to achieve better knowledge of possible teratogenic effects of medicines and recreational substances during pregnancy is the collection and follow-up of observational data. It is therefore important to monitor medicine and recreational substance use regularly among pregnant women in order to improve the evidence base on the safety of these agents.

2.2 Aim

To investigate the use of medicines (prescription, over-the-counter and complementary and alternative medicines) and recreational substances (licit and illicit substances) in an ethnically diverse antenatal population of London.

2.3 Objectives

1. To estimate the prevalence of medicine and recreational substance use before and during pregnancy.

2. To investigate the associations between participants' characteristics and medicine or recreational substance use in pregnancy.

3. To assess the knowledge of mothers about the safety of medicines and recreational substances in pregnancy.

4. To examine the mothers' medicines preferences for treating a new medical condition.

5. To determine pregnant women's potential sources of information on medicine and recreational substance use.

6. To explore the outcomes of the pregnancies and the relationship between use of medicines and recreational substances and adverse pregnancy outcomes.

2.4 Research Ethics

An ethics application for this study was submitted to the South East London REC 3 (Research Ethics Committee 3) for a multi-site study and approval was obtained. The R and D (Research and Development) approval was also sought from the sites before participants were recruited for the study.

2.5 Methods

2.5.1 Study Design

The design was both cross-sectional (at 2 sites) and prospective cohort study (at 1 site). This is because R and D authorisation for the cross-sectional study was granted at 2 sites while prospective cohort study authorisation was granted only at 1 site. A cross-sectional study design was used for objectives 1 to 5 (section 2.3) while a prospective cohort study design was used for objectives 1 and 6.

A prospective cohort study is one in which a group of subjects, selected to represent the population of interest, is studied over time. The study is carried out from the present time into the future and information is collected at distinct points in time about the exposure to risk factors and outcome of interest. Prospective cohort studies may be either fixed, where the study subjects do not vary over time and dropouts are not replaced, or dynamic, where new subjects enter the study in accordance with eligibility criteria. This type of study is observational and used to examine causal factors (Levin,

2003). Unlike cross-sectional studies where information is collected about the exposure to risk factors and outcomes simultaneously at a specific point in time, the longitudinal nature of prospective cohort studies enables the assessment of causal hypotheses since exposure is seen to occur before the outcome (Hennekens and Buring, 1987; Levin, 2003).

The prospective cohort study is therefore a valuable tool with important applications in epidemiological studies. The design is more commonly used because accurate and complete data are readily available and it can be used to study more than one outcome. It also offers researchers the advantage of measuring outcomes in the real world without the ethical and logistical constraints faced by randomized controlled trials. However, prospective cohort studies have the disadvantages of being costly, time consuming, prone to dropouts, as well as concerns with internal validity due to the presence of selection bias and confounding variables (Bookwala et al., 2011).

2.5.2 Setting

This study was carried out at the antenatal outpatient units of 2 London teaching hospitals – University College London and St. Thomas' Hospitals. These central London hospitals provide antenatal services to 6,200 and 6,800 women respectively per year.

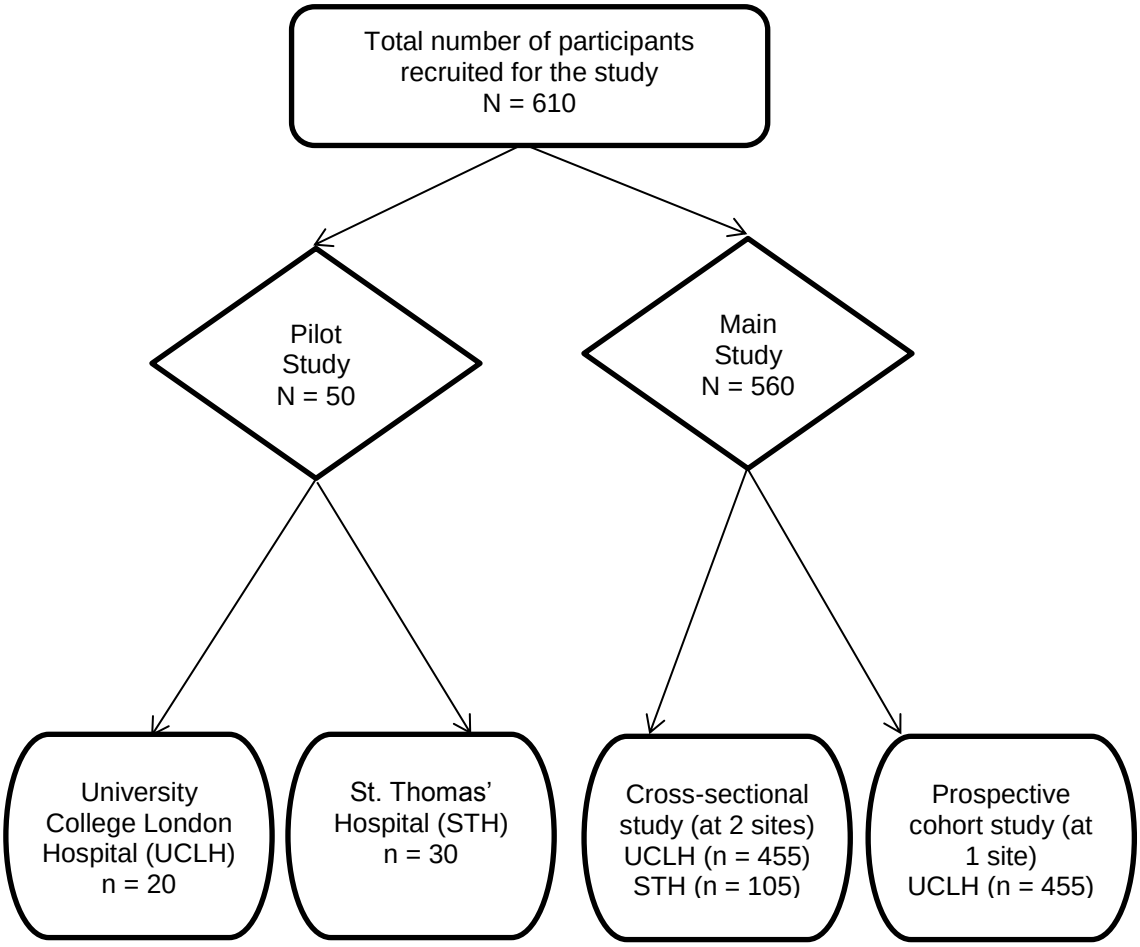

Figure 4 Recruitment flow chart

2.5.3 Data collection

2.5.3.1 A Cross-sectional study at University College London (UCLH) and St. Thomas' Hospitals (STH)

Potential participants were identified from appointment lists for routine antenatal ultrasound scans at each site and had information leaflets posted to them with their appointment letter by the maternity outpatient's staff. Women attending for their 11-13 week scan were recruited consecutively on alternate days of the week from the 2 hospitals. This recruitment pattern was also alternated every week at the 2 hospitals to reduce bias. Before their

scan, the purpose of the study was verbally explained and consent was obtained for carrying out a short interview after their ultrasound scan. Consenting participants were interviewed with a structured questionnaire about prescription, over-the-counter, complementary and alternative medicines and recreational substance (licit and illicit) use in the 3 months prior to and during their first trimester (Appendix 2). The interview lasted about 15 minutes. The questionnaire was developed by Prof. Alastair Sutcliffe of the Institute of Child Health, UCL. A pilot study was carried out in March 2011 with 50 patients (20 from UCLH and 30 from STH) to assess the feasibility of the project. The study protocol was then revised and submitted to the ethics committee for approval before commencing the main study. Hence, the results of the pilot study were reported separately from the main study. The main study was carried out from September 2011 to June 2012.

2.5.3.2 A prospective cohort study at University College London Hospital (UCLH)

As stated in sections 1.2.6.4 and 2.5.1 that prospective cohort study is the best method, a follow-up of participants recruited only at UCLH above was further carried out by telephoning women to obtain information about the second and third trimesters' medicine and recreational substance use. They were telephoned in the 23rd-25th week of their gestation for second trimester information, and 35-39th week for third trimester information. Consent for this was obtained during the first trimester interview. Women were classified as lost to follow up if they were telephoned and did not pick up on at least three occasions or if their numbers were not reachable. If a woman was lost to follow-up in the second trimester, she was not contacted again in the third

trimester. The follow-ups were carried out from December 2011 to January 2013.

The pregnancy outcomes for this cohort were obtained from the electronic medical records at UCLH in February 2013. The pregnancy outcomes of interest were preterm birth, congenital anomaly, low birth weight and admission to neonatal unit (NNU). The outcomes were retrieved and analysed as documented in the records. Twins were excluded from the analyses in order to avoid bias since they are usually preterm with low birth weight (Jobe, 2010; Bladh et al., 2013).

2.5.4 Ethical issues

Pregnant women are a vulnerable group of participants. Hence, the interviews were carried out at convenient times for the participants and in a private area where other people would not hear the conversations but within the hospital. If participants requested for information or advice about medicines, they were referred to the clinical team. Informed verbal and written consent were obtained from participants who were also assured of confidentiality and anonymity before the interviews were carried out. All questionnaires and medical records information were anonymised with a unique study subject number. The subject numbers and identities of the participants were stored separately with a password.

2.5.5 Inclusion criteria

Pregnant women over the age of 16 years who could communicate in English language and gave their consent.

2.5.6 Sample size

The sample size needed to estimate the prevalence of medicine and recreational substance use was calculated at 95% confidence level to be 400 pregnant women using the formula $N = Z^2 \times \frac{p\,(100 - p)}{e^2}$ where

Z = Z value at 95% confidence level which is approximately 2

p = expected prevalence which is 50%

e = precision ± 5%

2.5.7 Statistical Analyses

Descriptive statistics were performed to obtain the frequencies and percentages of participants' characteristics. Univariate analyses were carried out using chi-square tests and variables with $p < 0.1$ were then analysed using logistic regression where $p < 0.05$ was considered significant. Analyses were carried out with Statistical Package for Social Sciences (SPSS) version 21.

2.6 Results

2.6.1 Pilot Study (N = 50)

2.6.1.1 Sample Characteristics

The pilot study was carried out in March 2011. Fifty out of the 68 pregnant women that were approached participated in the study (8 women could not communicate in English language while 10 women did not give their consent), giving a response rate of 73.5%. The age of the participants was 30.8 ± 4.9 years (mean ± SD). As shown in Table 7 below, most of the

women (56.0%) were between 31 and 40 years old. They were mainly Whites (46.0%) as reported by the participants and multigravidas (56.0%). Thirty-two percent (16/50) reported previous obstetric problems, the most frequent of which was miscarriage (n = 11) followed by termination (n = 4). Half of the participants (n = 25) have previously given birth to one or more children and 22 of them mentioned having healthy children.

Table 7 Sample characteristics of the pilot study

Characteristic	n (%)
Age (years)	
≤ 20	1 (2.0)
21 – 30	20 (40.0)
31 – 40	28 (56.0)
41 – 50	1 (2.0)
Ethnic origin	
White	23 (46.0)
Black origin	11 (22.0)
Asian	8 (16.0)
Other	8 (16.0)
Gravidity	
1	22 (44.0)
≥ 2	28 (56.0)
Previous obstetric problems	
Yes	16 (32.0)
No	12 (24.0)
Not Applicable	22 (44.0)
Parity	
0	25 (50.0)
≥ 1	25 (50.0)
Previous healthy child(ren)	
Yes	22 (44.0)
No	3 (6.0)
Not Applicable	25 (50.0)

Lifestyle variables (early pregnancy)	
Coffee	
Yes	14 (28.0)
No	36 (72.0)
Tea	
Yes	24 (48.0)
No	26 (52.0)
Cola	
Yes	1 (2.0)
No	49 (98.0)
Lifestyle variables (before pregnancy)	
Coffee	
Yes	21 (42.0)
No	29 (58.0)
Tea	
Yes	28 (56.0)
No	22 (44.0)
Cola	
Yes	8 (16.0)
No	42 (84.0)

2.6.1.2 Prevalence of medicine and recreational substance use

Ninety-eight percent (49/50) of the participants had used at least one medicine or recreational substance in the first trimester. Folate supplementation was found in 90% of the women. Except for over-the-counter and complementary and alternative medicines, there were reductions in the use of prescription medicines, alcohol and cigarette in the first trimester when compared to the use before pregnancy. Cannabis consumption before pregnancy was reported by 3 of the women but none of

them declared using it in early pregnancy (Table 8). The list of medicines and recreational substances used before and in the first trimester are displayed in Table 9. The prescription medicines have been grouped according to the World Health Organisation ATC (Anatomical Therapeutic Chemical) classification system.

Table 8 Self-reported use of medicines and recreational substances 3 months before pregnancy and in early pregnancy

Medicine/Substance	Before pregnancy	Early pregnancy
	n (%)	**n (%)**
Prescription medicines	12 (24.0)	5 (10.0)
Over-the-counter medicines	28 (56.0)	44 (88.0)
Complementary and alternative medicines	5 (10.0)	6 (12.0)
Alcohol	26 (52.0)	5 (10.0)
Cigarette	7 (14.0)	1 (2.0)
Illicit substances	3 (6.0)	0 (0.0)

Table 9 List of medicines and recreational substances used before and in early pregnancy

Before pregnancy	Early pregnancy
Prescription medicines (B) Blood and blood forming organs – Warfarin. (C) Cardiovascular system – Amlodipine, losartan. (G) Genitourinary system and sex hormones – desogestrel, levonorgestrel, ethinylestradiol + drospirenone, ethinylestradiol + levonorgestrel, ethinylestradiol + gestodene. (M) Musculoskeletal system – Diclofenac (R) Respiratory system – Loratadine **Over-the-counter medicines** Multivitamins (including folic acid) Mineral supplements – Calcium and iron Analgesics – Paracetamol, aspirin, ibuprofen, aspirin + caffeine Antihistamine – Diphenhydramine, loratadine Antispasmodic – Hyoscine butylbromide Antacids **Complementary and alternative medicines** Camomile, peppermint, green tea, Chinese herbal tea, acupuncture. **Recreational substances** Alcohol, cigarette and cannabis	**Prescription medicines** (A) Alimentary tract and metabolism – Mesalazine (B) Blood and blood forming organs – Folic acid, 75mg aspirin. (C) Cardiovascular system – Aldomet, amlodipine, losartan. (J) Anti-infectives for systemic use – Penicillin (L) Antineoplastic and immunomodulating agents – Azathioprine (P) Antiparasitic products – Atovaquone + proguanil hydrochloride (R) Respiratory system – Salbutamol inhaler **Over-the-counter medicines** Multivitamins (including folic acid) Mineral supplements – Calcium and iron Analgesic – Paracetamol Antihistamine – Loratadine Antispasmodic – Colpermin **Complementary and alternative medicines** Camomile, peppermint, green tea, ginger, lemon grass, massage. **Recreational substances** Alcohol and cigarette

2.6.1.3 Sources of information on medicine and recreational substance use in pregnancy

When the women were asked where they would go if they needed more information on medicine or recreational substance use, the most frequently cited source was the General Practitioner (GP). This is displayed in Figure 5.

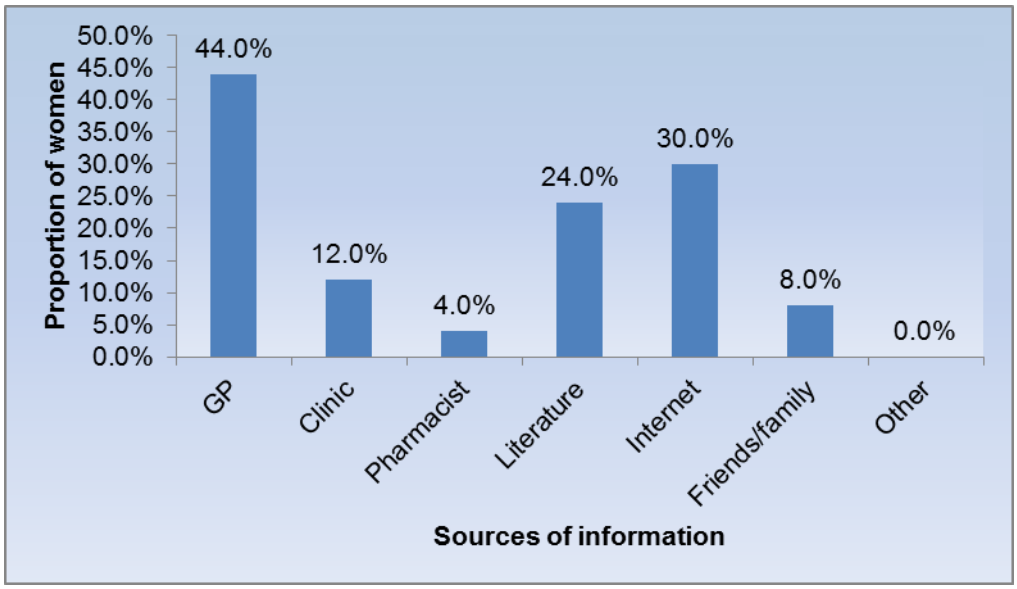

Figure 5 Sources of information about medicines and substances in pregnancy

2.6.1.4 Summary

The aim of the pilot study was to assess the feasibility of the project. During the pilot study, it was not difficult to approach and explain the study to potential participants and to use the questionnaire. It was also observed that the questions were not ambiguous although majority of the participants needed more explanation about complementary and alternative medicines. The range of time taken to complete the questionnaire was between 13 – 15 minutes.

The high response rate of 73.5% indicated that the participants considered the study to be important. Hence, the pilot study showed that the study is feasible and that the required sample size can be reached within a reasonable time frame. However in order to enrich the outcome measures of the study, the educational status, safety knowledge and medicines preferences of the participants were included in the questionnaire. These amendments were submitted to and approved by the ethics committee before commencement of the main study.

2.6.2 Main Cross-sectional Study (N = 560)

The updated questionnaire which included the educational status of the subjects, the safety knowledge about medicines and recreational substances as well as the medicine preferences was used in data collection in this main study. The study was carried out from September 2011 to June 2012.

2.6.2.1 Participants' Characteristics

Six hundred and seven women were approached out of which 21 could not communicate in English language and 26 did not provide their consent. This left a total of 560 participants in the study – a response rate of 92.3%. Their age was 31.9 ± 5.1 years (mean ± SD).

As presented in Table 10, more than 58% of the participants were in the age range of 31-40 years, 66.8% were Whites and 74.1% were university degree holders. About 62% of the women had one or more prior pregnancies while 31.8% (178/560) had experienced problems in previous pregnancies. These obstetric problems were mainly miscarriages (n = 124) and termination (n =

57). There were few other obstetric problems such as ectopic pregnancies, heterotopic pregnancies and preterm labour due to infection (n = 15). About 53% of the participants were nulliparous and 44.6% had previously given birth to healthy children.

Table 10 Participants' characteristics

Characteristic	n (%)
Age (years)	
≤ 20	12 (2.1)
21 – 30	194 (34.6)
31 – 40	329 (58.8)
41 – 50	25 (4.5)
Ethnic origin	
White	374 (66.8)
Black origin	68 (12.1)
Asian	51 (9.1)
Other	67 (12.0)
Educational status	
Below university qualification	145 (25.9)
University qualification	415 (74.1)
Gravidity	
1	211 (37.7)
≥ 2	349 (62.3)
Previous obstetric problems	
Yes	178 (31.8)
No	171 (30.5)
Not Applicable	211 (37.7)
Parity	
0	299 (53.4)
≥ 1	261 (46.6)
Previous healthy child(ren)	
Yes	250 (44.6)
No	11 (2.0)
Not Applicable	299 (53.4)

Table 10 Participants' characteristics (continued)

Characteristic	n (%)	
Lifestyle variables	**Before pregnancy**	**Early pregnancy**
Coffee		
Yes	266 (47.5)	172 (30.7)
No	294 (52.5)	388 (69.3)
Tea		
Yes	298 (53.2)	248 (44.3)
No	262 (46.8)	312 (55.7)
Cola		
Yes	82 (14.6)	66 (11.8)
No	478 (85.4)	494 (88.2)

2.6.2.2 Prevalence of medicine and recreational substance use

In all, 30.5%, 49.5% and 30.2% of the study participants were exposed to prescription, over-the-counter, and complementary and alternative medicines respectively in the 3 months prior to pregnancy. These figures rose to 37.9%, 86.6% and 40.5% in the first trimester. However, after excluding multivitamins and mineral supplements, the prevalence of use of prescription and over-the-counter medicines was 27.7% and 25.5% respectively (Table 11). 15.4% (22/143) of the over-the-counter medicine users reported using 2 or more of such medicines, 38.1% (59/155) of those exposed to prescription medicines reported using 2 or more, while more than half of complementary and alternative medicine users (130/227) reported using 2 or more modalities.

The prevalence of alcohol, cigarette and illicit substance consumption before pregnancy was 64.3%, 13.2% and 2.3% respectively. In the first trimester,

the proportions of women who reported the consumption of these substances were 11.4% for alcohol, 3.0% for cigarette and 0.4% for illicit substance. The only illicit substance that was reportedly taken prenatally was cannabis. Before pregnancy, 10 women reported the use of cannabis, 5 reported cocaine use and 1 reported MDMA (Methylene dioxymethamphetamine) use.

Table 11 Prevalence of medicine and recreational substance use

Medicine/Substance	Before pregnancy n (%)	Early pregnancy n (%)
Prescription medicines	171 (30.5)	155 (27.7)
Over-the-counter medicines	277 (49.5)	143 (25.5)
Complementary and alternative medicines	169 (30.2)	227 (40.5)
Alcohol	360 (64.3)	64 (11.4)
Cigarette	74 (13.2)	17 (3.0)
Illicit substances	13 (2.3)	2 (0.4)

The frequencies of use of prescription and over-the-counter medicines are presented in Tables 12 and 13. The medicines have been grouped according to the Anatomical Therapeutic Chemical (ATC) classification.

In the case of prescription medicines, the number of women with prescribed medicines in the ATC group A (Alimentary tract and metabolism) increased by over 150% from the period prior to pregnancy to the first trimester due mainly to the use of metoclopramide (for pregnancy-induced nausea and

vomiting), vitamin D + calcium, antacids and ranitidine. The Blood and blood forming products (ATC group B) had the highest frequency of use in early pregnancy (n = 128). This is because of the increase in prescriptions for folic acid (either singly or in combination with other vitamins) and antithrombotic agents. In the 3 months before pregnancy, the number of times that the medicines in this group were used was 23. In the Dermatologicals (group D), retinol cream was prescribed three times before pregnancy but not in the first trimester. Prescriptions for Genitourinary system and sex hormones (group G) before pregnancy were almost two and a half times the ones in the first trimester because of the reported use of oral contraceptives.

The increase in the use of group H medicines – Systemic hormonal preparations from the period before pregnancy to the first trimester was due to increases in the prescriptions for levothyroxine. There was also an increase in the use of ATC group J (Anti-infectives) in early pregnancy compared to before pregnancy which was as a result of the rise in the use of amoxicillin for indications such as urinary tract and respiratory infections. A reduction in the number of prescriptions for Nervous system medications (group N) from the period before pregnancy (n = 38) to early pregnancy (n = 24) was observed. There were decreases in the use of analgesics and antidepressants in early pregnancy compared to the 3 months prior pregnancy. There was an increase in the reported frequency of use of ATC group R medications - Respiratory System – in pregnancy due to prescriptions received for promethazine and cyclizine, both of which were used in treating pregnancy-induced nausea and vomiting.

Exposures to Cardiovascular medicines (group C), Antineoplastic and immunomodulating agents (group L), Musculoskeletal products (group M), Antiparasitic products (group P) and Sensory organ medicines (group S) before and during early pregnancy were low.

Table 12 Frequency of use of prescription medicines before and in early pregnancy, by ATC group

Before pregnancy	n	Early pregnancy	n
(A) Alimentary tract and metabolism	**14**	**(A) Alimentary tract and metabolism**	**37**
Omeprazole	3	Antacids	3
Vitamin D + calcium	7	Vitamin D + calcium	12
Insulin	2	Metoclopramide	8
Mesalazine	2	Ondansetron	1
		Ranitidine,	4
		Omeprazole	1
		Lactulose solution	1
		Lubiprostone	1
		Domperidone	2
		Mesalazine	2
		Insulin	2
(B) Blood and blood forming organs	**23**	**(B) Blood and blood forming organs**	**128**
Folic acid	12	Folic acid	77
Iron preparations	7	Iron preparations	13
Aspirin 75mg	4	Aspirin 75mg	23
		Enoxaparin	11
		Dalteparin	4
(C) Cardiovascular system	**2**	**(C) Cardiovascular system**	**5**
Propranolol	1	Propranolol, bisoprolol and	3
Methyldopa	1	labetalol.	
		Methyldopa	2

Table 12 Frequency of use of prescription medicines before and in early pregnancy, by ATC group (continued)

Before pregnancy	n	Early pregnancy	n
(D) Dermatologicals	**7**	**(D) Dermatologicals**	**6**
Erythromycin + zinc acetate	1	Erythromycin + zinc acetate	1
Retinol	3	Betamethasone	1
clobetasol propionate	2	Clobetasol propionate	2
clobetasol butyrate	1	Clobetasol butyrate	2
(G) Genitourinary system and sex hormones	**74**	**(G) Genitourinary system and sex hormones**	**30**
Ethinylestradiol + levonorgestrel	31 24	Progestogen Estradiol	24 5
Ethinylestradiol + drospirenone	16	Bromocriptine	1
Desogestrel	1		
Clomiphene	2		
Bromocriptine			
(H) Systemic hormonal preparations (excluding sex hormones and insulins)	**18**	**(H) Systemic hormonal preparations (excluding sex hormones and insulins)**	**28**
Levothyroxine	15	Levothyroxine	21
Prednisolone	3	Carbimazole	1
		Prednisolone	5
		Dexamethasone	1

Table 12 Frequency of use of prescription medicines before and in early pregnancy, by ATC group (continued)

Before pregnancy	n	Early pregnancy	n
(J) Anti-infectives for systemic use	**16**	**(J) Anti-infectives for systemic use**	**39**
Penicillin	4	Penicillin	3
Amoxicillin	4	Pivmecillinam	1
Doxycycline	2	Flucloxacillin and cloxacillin	2
Pivmecillinam	1	Amoxicillin	20
Trimethoprim	1	Cephalexin	6
Acyclovir	1	Erythromycin	2
Emtricitabine + tenofovir	1	Nitrofurantoin	1
Darunavir	1	Emtricitabine + tenofovir	1
Zidovudine	1	Darunavir	1
		Zidovudine	1
		Anti-D (rh) immunoglobulin	1
(L) Antineoplastic and immunomodulating agents	**3**	**(L) Antineoplastic and immunomodulating agents**	**2**
Hydroxycarbamide	1	Azathioprine	
Azathioprine	2		
(M) Musculoskeletal system	**5**	**(M) Musculoskeletal system**	**1**
Alendronic acid	1	Diclofenac	
Diclofenac	4		

Table 12 Frequency of use of prescription medicines before and in early pregnancy, by ATC group (continued)

Before pregnancy	n	Early pregnancy	n
(N) Nervous system	**38**	**(N) Nervous system**	**24**
Sumatriptan, zolmitriptan, almotriptan and rizatriptan.	7	Paracetamol	6
		Codeine	2
Naproxen, ibuprofen, codeine, dihydrocodeine + paracetamol, and codeine + paracetamol.	9	Paracetamol + codeine	3
		Sertraline, citalopram and fluoxetine.	8
Amitriptyline, fluoxetine, sertraline, bupropion, alprazolam and citalopram.	20	Prochlorperazine	3
		Lamotrigine	2
Lamotrigine	2		
(P) Antiparasitic products	**2**	**(P) Antiparasitic products**	**1**
Hydroxychloroquine	1	Hydroxychloroquine	
Mefloquine	1		

Table 12 Frequency of use of prescription medicines before and in early pregnancy, by ATC group (continued)

Before pregnancy	n	Early pregnancy	n
(R) Respiratory system	**36**	**(R) Respiratory system**	**47**
Xylometazoline nasal spray	4	Xylometazoline nasal spray	3
Loratadine, cetirizine, and chlorphenamine.	4	Beclometasone nasal spray	1
		Promethazine	2
Salbutamol, salmeterol, terbutaline, beclometasone, fluticasone, fluticasone + salmeterol, budesonide and budesonide + formoterol.	27	Cyclizine	10
		Salbutamol, salmeterol, fluticasone, budesonide, terbutaline, beclometasone, fluticasone + salmeterol, budesonide + formoterol.	27
Montelukast	1		
		Doxylamine + pyridoxine	1
		Cough and cold preparations	3
(S) Sensory organs	**3**	**(S) Sensory organs**	**2**
Dexamethasone eye drops		Dexamethasone eye drops	

Regarding over-the-counter medicines, there was an increase in the use of Alimentary tract medicines from the 3 months before pregnancy to early pregnancy period due to increased exposure to antacids (for the treatment of heartburn and flatulence) and vitamin D + calcium supplement. Blood and blood forming products had the highest frequency of use in early pregnancy due to maternal intake of folic acid to prevent neural tube defects. This increase in use in early pregnancy compared to before pregnancy was more than 100%.

The use of clotrimazole pessaries for vaginal thrush which was not reported before pregnancy had a frequency of 7 in early pregnancy. It was interesting to observe that before pregnancy, use of analgesics (Nervous system medicines) was much higher than in the first trimester. The most common analgesics were paracetamol (n = 115) and ibuprofen (n = 78) before pregnancy. These figures decreased to 105 and 6 for paracetamol and ibuprofen respectively in the first trimester. There was also a marked reduction in the use of respiratory medicines in early pregnancy when compared to prior pregnancy. This was because antihistamines were not reportedly used over-the-counter in the first trimester as compared to before pregnancy. There was also a reduction in the use of cough and cold preparations from 16 before pregnancy to 6 during pregnancy. Exposure to Dermatologicals and Musculoskeletal system products was low both before and during pregnancy.

Table 13 Frequency of use of over-the-counter medicines before and in early pregnancy, by ATC group

Before pregnancy	n	Early Pregnancy	n
(A) Alimentary tract and metabolism	**27**	**(A) Alimentary tract and metabolism**	**53**
Antacids	5	Antacids	19
Vitamin D + calcium	13	Vitamin D + calcium	29
Simethicone	1	Simethicone	1
Omeprazole	2	Omeprazole	1
Ranitidine	1	Ispaghula	3
Ispaghula	1		
Docusate sodium	2		
Domperidone	1		
Hyoscine butylbromide	1		
(B) Blood and blood forming organs	**141**	**(B) Blood and blood forming organs**	**327**
Folic acid	138	Folic acid	316
Iron preparations	3	Iron preparations	7
		Aspirin 75mg	4
(D) Dermatologicals	**3**	**(D) Dermatologicals**	**3**
Hydrocortisone	1	Hydrocortisone	1
Clotrimazole	2	Hydrocortisone + clotrimazole	1
		Hydrocortisone + miconazole	1
(G) Genitourinary system and sex hormones	**0**	**(G) Genitourinary system and sex hormones**	**7**
		Clotrimazole pessaries	
(M) Musculoskeletal system	**2**	**(M) Musculoskeletal system**	**1**
Glucosamine sulphate		Glucosamine sulphate	

Table 13 Frequency of use of over-the-counter medicines before and in early pregnancy, by ATC group (continued)

Before pregnancy	n	Early Pregnancy	n
(N) Nervous system	**204**	**(N) Nervous system**	**111**
Paracetamol	115	Paracetamol	105
Ibuprofen	78	Ibuprofen	6
Aspirin	6		
Mefenamic acid	1		
Paracetamol + codeine + doxylamine + caffeine	2		
Naproxen	1		
Codeine	1		
(R) Respiratory system	**34**	**(R) Respiratory system**	**15**
Loratadine	7	Beclometasone nasal spray	1
Diphenhydramine	2	Xylometazoline nasal spray	7
Cetirizine	4	Isotonic solution nasal spray	1
Beclometasone nasal spray	3	Cough and cold preparations	6
Xylometazoline nasal spray	2		
Cough and cold preparations	16		

The categories of complementary and alternative medicines which were used as well as the frequency of use are presented in Table 14. There was over 50% increase in the use of Natural products in early pregnancy (n = 356) in comparison to the 3 months prior to pregnancy (n = 229). The most commonly used natural products were ginger, peppermint and camomile which were used to treat pregnancy-related conditions such as nausea and vomiting and indigestion. The most common Mind-body medicines were

yoga and acupuncture but these found reduction in use during pregnancy compared to before pregnancy. Yoga was used for exercise and relaxation while acupuncture was used for vomiting due to pregnancy. The Manipulative and body-based practices that were used are massage, osteopathy and chiropractic therapy which were used for differing indications like back ache and stress. Massage was the most common and its use decreased in the first trimester compared to before pregnancy. In the "Other CAM practices" category, the use of homeopathic remedies and aromatherapy increased during early pregnancy compared to before pregnancy.

Table 14 Frequency of use of complementary and alternative medicines (CAM) before and in early pregnancy

Before pregnancy	**n**	**Early Pregnancy**	**n**
Natural Products	**229**	**Natural Products**	**356**
Ginger tea	40	Ginger capsules, powder or tea.	72
Peppermint tea	53	Peppermint tea	96
Camomile tea	36	Camomile tea	70
Lemon tea	28	Lemon tea	26
Green tea	23	Green tea	31
Fennel tea	8	Senna tea	1
Redbush tea	11	Fennel tea	11
Nettle tea	1	Redbush tea	23
Lady's mantle tea	1	Nettle tea	3
Milk thistle	1	Jasmine tea	5
Valerian	2	Dandelion	1
St. John's wort	1	Cranberry juice	2
Ginseng	1	Echinacea tablets	2
Dandelion	1	Cinnamon tablets	1
Raspberry leaf tea	1	Garlic tablets	3
Cranberry juice	1	Evening primrose oil	1
Echinacea tablets	4		
Cinnamon tablets	1		

Table 14 Frequency of use of complementary and alternative medicines (CAM) before and in early pregnancy (continued)

Before pregnancy	n	Early Pregnancy	n
Garlic tablets	2	Multivitamins and mineral tablets and syrup.	8
Evening primrose oil	4		
Multivitamins and mineral tablets and syrup.	9		
Mind-Body medicine	**58**	**Mind-Body medicine**	**44**
Yoga	29	Yoga	20
Acupuncture	26	Acupuncture	20
Reflexology	3	Acupressure bands	3
		Reflexology	1
Manipulative and body-based practices	**28**	**Manipulative and body-based practices**	**16**
Massage	23	Massage	13
Osteopathy	3	Osteopathy	2
Chiropractic therapy	2	Chiropractic therapy	1
Other CAM practices	**21**	**Other CAM practices**	**27**
Chinese medicine	3	Chinese medicine	2
Homeopathic remedies	11	Homeopathic remedies	16
Aromatherapy	5	Aromatherapy	7
Alexander technique	1	Alexander technique	1
Pilates	1	Pilates	1

2.6.2.3 Associations between participants' characteristics and medicine or recreational substance use in early pregnancy

Univariate analyses were carried out with chi-square test to determine the associations between participants' characteristics and the use of medicine or recreational substance in the first trimester and $p < 0.1$ was considered significant. The selected variables were then tested in multivariate analyses with logistic regression and $p < 0.05$ was considered significant.

Compared to non-users, prescription medicine users were more likely to:

- be university-educated,
- have been pregnant at least once before.

In the multivariate analysis, education (AOR 1.895; 95%CI 1.134 - 3.168) and gravidity (AOR 1.565; 95%CI 1.032 - 2.372) remained significantly associated with prescription medicine use in early pregnancy.

When compared to non-users, over-the-counter medicine users were more likely to:

- be in the age group of 31 - 40 years,
- be whites,
- be university-educated,
- have been pregnant at least once before,
- have given birth at least once before,
- have consumed tea.

Multivariate analysis showed that parity (AOR 1.740; 95%CI 1.153 – 2.628), tea consumption (AOR 1.779; 95%CI 1.190 – 2.661), age and ethnic origin were significantly associated with over-the-counter medicine use. Relative to those in the age group of 31 – 40 years, over-the-counter medicine use was less likely in women between 21 – 30 years old (AOR 0.482; 95%CI 0.293 – 0.793). Furthermore, relative to whites, women of black origin (AOR 0.394; 95%CI 0.184 – 0.845) or Asians (AOR 0.247; 95%CI 0.094 – 0.652) were less likely to report over-the-counter medicine use.

In comparison to non-users, complementary and alternative medicine users were more likely to:

- be between 31 and 40 years old,
- be whites,
- be university-educated,
- have never given birth, and
- have not consumed coffee.

In the multivariate analysis, education (AOR 1.947; 95%CI 1.200 – 3.161) and age remained significantly associated with complementary and alternative medicine use. Relative to those in the age group of 31 – 40 years, complementary and alternative medicine use was less likely in women between 21 – 30 years old (AOR 0.539; 95%CI 0.355 – 0.819).

Compared to non-users, women who have taken alcohol were more likely to:

- be in the age group of 31- 40 years,
- be whites,

- be university-educated,
- have been pregnant at least once before,
- have given birth at least once before,
- have consumed tea.

Multivariate analysis indicated that tea consumption (AOR 2.522; 95%CI 1.438 – 4.424) and age remained significantly associated with alcohol consumption. Relative to those in the age group of 31 – 40 years, alcohol consumption was less likely in women between 21 – 30 years old (AOR 0.300; 95%CI 0.133 – 0.674).

Compared to non-smokers, cigarette smokers were more likely to:

- be younger (between 21 and 30 years old),
- have education which is below the university level,
- have consumed coffee, and
- have not taken cola drinks.

Multivariate analysis demonstrated that coffee consumption (AOR 2.947; 95%CI 1.031 – 8.423) and education (AOR 0.081; 95%CI 0.021 – 0.317) remained significantly associated with cigarette smoking.

Users of cannabis were more likely to be older (> 30 years) compared to non-users.

All other characteristics did not differ significantly between users and non-users of the medicines or substances in pregnancy (Appendices 3 and 4).

2.6.2.4 Safety Knowledge and Medicine Preferences

In terms of information on the safety of medicines and recreational substances in pregnancy, it was observed that 37.0% of the participants felt they had little or no information about prescription medicines, 36.2% believed they had little or no information about over-the-counter medicines and 57.1% reported having little or no information about complementary and alternative medicines. In contrast, 94.6% of the women felt they had enough information about licit substances while 80.0% thought they had enough information about the safety of illicit substances in pregnancy (Figure 6).

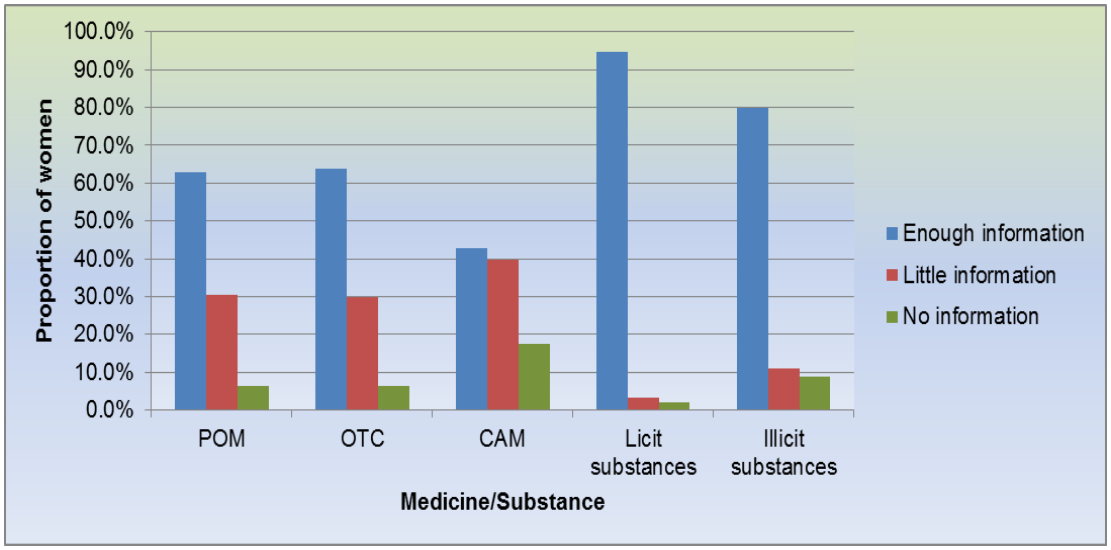

Figure 6 Reported safety information about medicines and substances in pregnancy

*POM = Prescription medicines; OTC = Over-the-counter medicines; CAM = Complementary and alternative medicines

When all the study participants were asked to compare the safety of CAM to conventional medicines, 12.3% felt CAM is safer, 27% thought both CAM and conventional medicines are equally safe, 15.9% felt CAM is less safe while 44.8% felt they did not know about the safety of CAM compared to conventional medicines (Figure 7). Furthermore, in treating a new medical

condition, 17.1% of the participants would choose CAM rather than conventional medicines as their most preferred therapy.

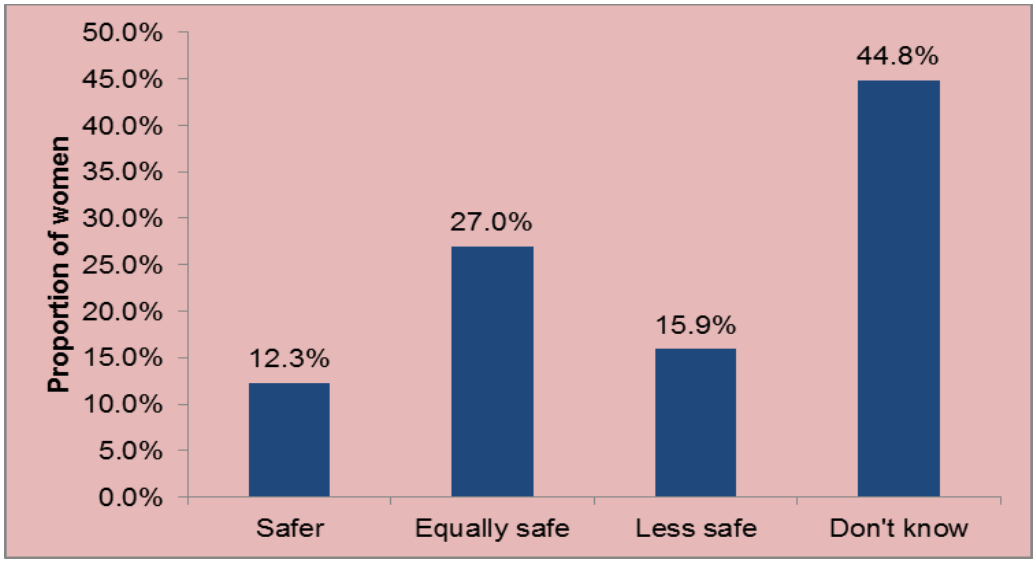

Figure 7 Comparison of the safety of CAM to conventional medicines

2.6.2.5 Sources of information on medicine and recreational substance use in pregnancy

As illustrated in Figure 8, the GP (72.0%) and the internet (51.1%) were commonly chosen by participants as their sources for further information on medicine or recreational substance use in pregnancy.

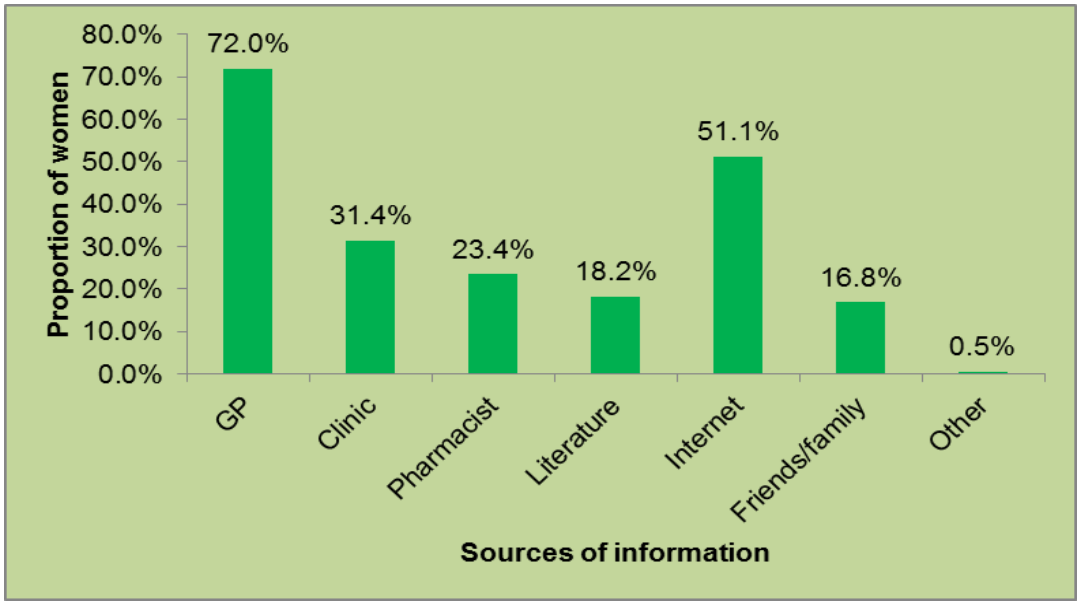

Figure 8 Potential sources of information on medicines or substances in pregnancy

2.6.3 Prospective cohort study (N = 455)

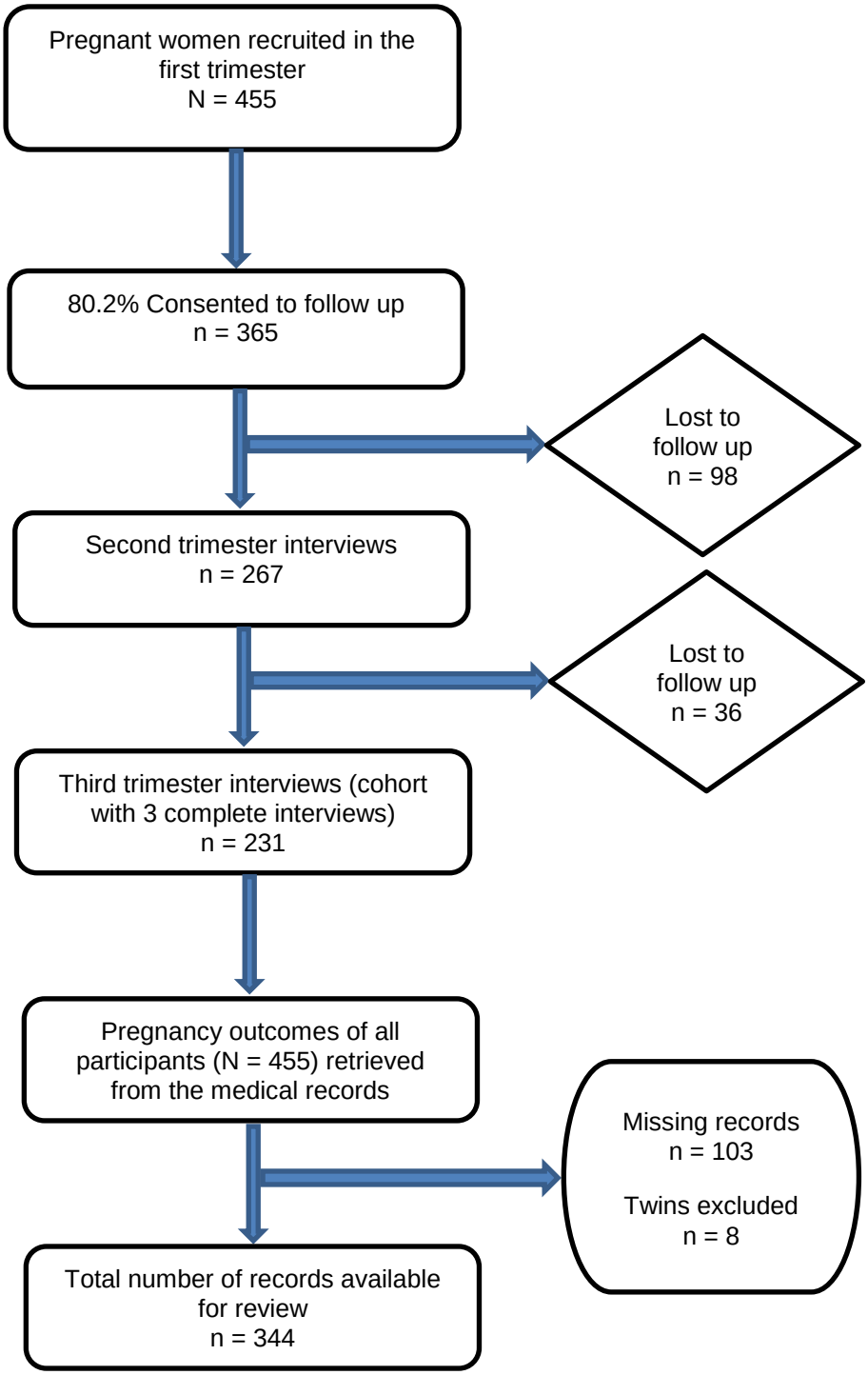

Figure 9 The data collection process

2.6.3.1 Characteristics of the cohort

As illustrated in Figure 9, 455 women were recruited in the first trimester out of which 365 (80.2%) consented to be followed up in the other trimesters. Two hundred and sixty-seven participants were interviewed in the second trimester. In the third trimester, 231 interviews were carried out (19 women were interviewed within 1 week postpartum); all others were lost to follow-up. Therefore, the number of participants who completed the 3 interviews was 231. The characteristics of the cohort are similar to those described in section 2.6.2.1 (the cross-sectional study) because they were from the same population.

2.6.3.2 Prevalence of medicine and recreational substance use before and during pregnancy

As shown in Table 15, prescription medicine use was 30.8% in the 3 months before pregnancy and this decreased to 9.5% in the third trimester (after excluding multivitamins and mineral supplements). Over-the-counter medicines which had a prevalence of 52.7% before pregnancy decreased to 25.1% in the second trimester but increased to 40.3% in the third trimester (after excluding multivitamins and mineral supplements). The proportion of complementary and alternative medicine users was 32.7% prior to pregnancy and this increased to 49.8% in the third trimester. There was a statistically significant difference in the prevalence of use of prescription, over-the-counter, and complementary and alternative medicines in the first, second and third trimesters ($p < 0.0001$).

For the cohort with complete interviews (n = 231), the proportion of participants who have used prescription, over-the-counter and

complementary and alternative medicines in at least one trimester were 32.5%, 50.2% and 57.1% respectively.

Alcohol and cigarette had prevalence of 69.2% and 13.2% before pregnancy respectively. These reduced to 11.4% and 2.4% in the first trimester but increased slightly in the second and third trimesters for alcohol and cigarette respectively. During pregnancy, the average units of alcohol consumed per week was 1.5 and the average number of cigarette sticks which was smoked per day was seven. There was a statistically significant difference in the exposures to alcohol and cigarette in the first, second and third trimesters ($p < 0.0001$). A reduction in the percentages of participants who admitted to the use of illicit substances in pregnancy was found compared to before pregnancy. The prevalence of use of alcohol, cigarette and illicit substances in at least one trimester of the cohort with complete interviews were 16.0%, 3.5% and 0.9% respectively.

Table 15 Reported use of medicines and recreational substances before and during pregnancy, by trimesters

Medicine/Substance	**Before Pregnancy**	**During Pregnancy (by trimesters)**			
	n = 455	**1st (n = 455)**	**2nd (n = 267)**	**3rd (n = 231)**	**At least one trimester (n = 231)**
	n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**
Prescription medicines	140 (30.8)	122 (26.8)	29 (10.9)	22 (9.5)	75 (32.5)
Over-the-counter medicines	240 (52.7)	126 (27.7)	67 (25.1)	93 (40.3)	116 (50.2)
Complementary and alternative medicines	149 (32.7)	202 (44.4)	122 (45.7)	115 (49.8)	132 (57.1)
Alcohol	315 (69.2)	52 (11.4)	33 (12.4)	33 (14.3)	37 (16.0)
Cigarette	60 (13.2)	11 (2.4)	7 (2.6)	7 (3.0)	8 (3.5)
Illicit substances	10 (2.2)	2 (0.4)	1 (0.4)	1 (0.4)	2 (0.9)

2.6.3.3 Neonatal characteristics and Pregnancy outcomes

Out of the 455 participants, 103 medical records were missing due to transferred care by the mother to another hospital (n = 65), and unavailable electronic records (n = 38). Eight sets of twins were excluded to avoid bias in the results (section 2.5.3.2). This left a total of 344 medical records for review (Figure 9).

Fifty-eight point four percent (58.4%) of the neonates were females while 41.6% were males. The gestational age of the neonates was 39.47 ± 2.39 weeks (mean ± SD) and 50.6% were between 35.01 and 40.00 weeks old at birth. More than half of them had birth weights between 2.51 and 3.50 kilogrammes (mean ± SD = 3.35 ± 0.56 kg). Their recorded head circumference was 34.28 ± 1.63 centimetres and about three-quarters of them had measurements between 30.01 and 35.00 cm. The birth length was 51.90 ± 3.46 centimetres and over 50% had lengths which were greater than 50cm. The mean APGAR (Appearance, Pulse, Grimace, Acitivity, Respiration) scores at 1, 5 and 10 minutes were 8.6, 9.7 and 10 respectively.

Twenty-six out of 341 babies (7.6%) were preterm (delivery from 28 up to 37 completed weeks of gestation) while 5.3% (18/341) had low birth weight (birth weight < 2.50kg).

The proportion of neonates with documented congenital anomalies was 3.8% (13/344). Left positional talipes, situs inversus totalis, hypospadias, bilateral positional talipes, clinodactyly and vaginal fistula without anal opening were documented.

Forty-four out of 344 neonates (12.8%) were admitted to the neonatal unit for conditions such as systemic infection, hypoglycaemia, hypothermia, tachypnoea, bradycardia, respiratory distress syndrome, preterm delivery, low birth weight, and jaundice requiring phototherapy.

Fifty-two out of 344 babies (15.1%) had other problems like difficulty in the establishment of feeding, grunting at birth, baby vomiting and mild jaundice. One case of termination of pregnancy due to foetal defect and another of miscarriage were included in this group. These results are presented in Table 16.

Table 16 Neonatal characteristics and Pregnancy outcomes

Characteristic	**n (%)**
Sex, n = 341	
Female	199 (58.4)
Male	142 (41.6)
Gestational age *(weeks),* n = 344	
≤ 25.00	3 (0.9)
25.01 – 30.00	1 (0.3)
30.01 – 35.00	10 (2.9)
35.01 – 40.00	174 (50.6)
40.01 – 45.00	156 (45.3)
Birth weight *(kg)*, n = 341	
≤ 1.50	3 (0.9)
1.51 – 2.50	15 (4.4)
2.51 – 3.50	188 (55.1)
3.51 – 4.50	131 (38.4)
4.51 – 5.50	4 (1.2)
Head circumference *(cm),* n = 325	
≤ 30.00	5 (1.5)
30.01 – 35.00	247 (76.0)
35.01 – 40.00	73 (22.5)

Table 16 Neonatal characteristics and Pregnancy outcomes (continued)

Characteristic	n (%)
Length *(cm),* n = 309	
≤ 45.00	12 (3.9)
45.01 – 50.00	84 (27.2)
50.01 – 55.00	166 (53.7)
55.01 – 60.00	45 (14.6)
60.01 – 65.00	2 (0.6)
APGAR at 1 minute, n = 341	
1	1 (0.3)
2 – 4	5 (1.5)
5 – 7	23 (6.7)
8 – 10	312 (91.5)
APGAR at 5 minutes, n = 338	
7	1 (0.3)
8 – 9	95 (28.1)
10	242 (71.6)
APGAR at 10 minutes, n = 194	
9	9 (4.6)
10	185 (95.4)
Preterm birth, n = 341	
No	315 (92.4)
Yes	26 (7.6)
Low birth weight, n = 341	
No	323 (94.7)
Yes	18 (5.3)
Congenital anomaly, n = 344	
No	331 (96.2)
Yes	13 (3.8)
Admission to NNU, n = 344	
No	300 (87.2)
Yes	44 (12.8)
Other problems, n = 344	
No	292 (84.9)
Yes	52 (15.1)

2.6.3.4 Associations between use of medicines and recreational substances during pregnancy and the pregnancy outcomes

Univariate analyses were carried out with chi-square test to determine the associations between use of medicines and recreational substances and the pregnancy outcomes and $p < 0.1$ was considered significant. Missing data were left as such and not inputted.

2.6.3.4.1 First trimester cohort (N = 455)

Congenital anomaly

The univariate analysis showed that compared to those without congenital anomalies, mothers of babies with congenital anomalies were more likely to have used (in the first trimester of pregnancy):

- POM + CAM + Alcohol
- CAM + Cigarette

Low birth weight

Compared to those without low birth weight babies, mothers of babies with low birth weights were more likely to:

- be Asians or 'Other' ethnic origin
- be pregnant for the first time
- have used prescription medicines

Preterm birth

Compared to those without preterm babies, mothers of preterm babies were more likely to have used prescription medicines in early pregnancy.

Admission to NNU

Compared to babies not admitted to NNU, mothers whose babies were admitted were more likely to be younger (age between ≤ 20 and 30 years).

Other Problems

Compared to babies who did not have 'other problems', mothers whose babies had 'other problems' were more likely to have:

- had previous obstetric problems,
- consumed tea,
- smoked cigarettes, and
- have not consumed coffee

All other variables did not differ significantly between mothers who had the pregnancy outcomes of interest and those who did not (Appendix 5).

2.6.3.4.2 Cohort with complete interviews (N = 231)

Congenital anomaly

The univariate analysis showed that compared to those without congenital anomalies, mothers of babies with congenital anomalies were more likely to have used (during at least one trimester of pregnancy):

- OTC
- OTC + CAM
- POM + OTC + CAM

Preterm birth

Compared to those without preterm babies, mothers of preterm babies were more likely to:

- be younger (between ≤ 20 and 30 years),
- be of Black origin, Asians or 'Other' ethnic group
- have education which is below university level,
- have consumed cola drinks, and
- did not have healthy children previously.

Low birth weight

Compared to those without low birth weight babies, mothers of babies with low birth weights were more likely to be:

- younger (between ≤ 20 and 30 years)
- Asians

Admission to NNU

Compared to babies not admitted to NNU, mothers whose babies were admitted were more likely to have used:

- OTC + Cigarette
- OTC + CAM + Cigarette
- CAM + Cigarette, and
- have not used CAM + Alcohol

Other Problems

Compared to babies who did not have 'other problems', mothers whose babies had 'other problems' were more likely to have:

- had previous obstetric problems,
- used POM + OTC,
- used POM + OTC + Cigarette,
- smoked cigarettes, and
- have not consumed coffee.

All other variables did not differ significantly between mothers who had the pregnancy outcomes of interest and those who did not (Appendix 6).

2.7 Discussion

In this study, the information on medicine and recreational substance use in pregnancy were collected by interviewing participants with a structured questionnaire. The data collected included prescription medicines, over-the-counter medicines, complementary and alternative medicines as well as recreational substances (licit and illicit substances). The study was conducted in two phases: a cross-sectional study and a prospective cohort study.

In the cross-sectional study which was carried out at University College London and St. Thomas' Hospitals, the use of medicines and recreational substances were investigated in the 3 months prior to and in the first trimester of pregnancy. It also assessed the characteristics associated with medicine or recreational substance use as well as pregnant women's safety

knowledge. The prospective cohort study was carried out only at University College London Hospital and it further explored medicine and recreational substance use in the second and third trimesters and the associations with pregnancy outcomes.

2.7.1 Cross-sectional study

The prevalence of use of prescription and over-the-counter medicines in the first trimester amongst the 560 participants was found to be 27.7% and 25.5% respectively (after excluding multivitamins and mineral supplements). The proportion of women exposed to complementary and alternative medicines was 40.5%, 11.4% took alcohol, 3.0% smoked cigarettes while 0.4% consumed cannabis. There is however a challenge in making comprehensive comparison of these findings with other studies because of the differences in study designs, sample sizes and the specific medicines or recreational substances studied. Previous reports have also showed that medicine or recreational substance use during pregnancy differs between countries and even varies in the same country over time (Zhu et al., 2010).

Some prior studies have reported higher prevalence of prenatal use of medicines and recreational substances and this may be because such studies reported the exposure throughout pregnancy; or in the case of prescription and over-the-counter medicines, multivitamins and mineral supplements were included in the figures.

There are no comparable UK studies for the prevalence of prescription, over-the-counter, complementary and alternative medicines as well as alcohol use in the first trimester which employed the same methods as the current study.

A similar study carried out in the US by Buitendijk and Bracken (1991) in which pregnant women were interviewed about their medicine use in the first trimester reported a prevalence of 27.3%. Two other prior studies with the same methodology reported higher prevalence of exposure to prescription medicines in the first trimester. A Norwegian study by Nordeng et al. (2001) reported a slightly higher prevalence of 29%. This could be due to the fact that pregnant women were recruited in early second trimester and interviewed about prescription medicine use in the first trimester, thus the subjects could have reported some medicine exposures which do not reflect first trimester use. An Irish study by Cleary et al. (2010) also reported a higher prevalence of 39.2% and this could be because of the geographical differences in prescription medicine use between the Republic of Ireland and the UK. Furthermore, the present study found that prescription medicine users were more likely to be university-educated and have been pregnant at least once before.

With respect to over-the-counter medicines, a similar study was carried out in the Republic of Ireland by Cleary et al. (2010). The authors found a prevalence of 19.5% whereas in the current study, 25.5% of the women were exposed to over-the-counter medicines in the first trimester. The lower prevalence reported by the previous research could be because the sample size of participants was higher (n = 61 252) than that of the present study (n = 560). Two other previous studies which employed same method as the current study demonstrated much lower prevalence of 5% (Li et al., 2003) and a much higher prevalence of 54.9% (Buitendijk and Bracken, 1991). Li and colleagues (2003) in their US study reported a prevalence of 5%

because the authors focused on NSAIDs (Non-steroidal anti-inflammatory drugs), aspirin and paracetamol. Another US research (Buitendijk and Bracken, 1991) reported that 54.9% of their study participants were exposed to over-the-counter medicines. This is higher than the present study and could be explained by international variations in the medicines which are available over-the-counter. It was also discovered that users of over-the-counter medicines in the current study were more likely to be in the age group of 31 – 40 years, whites, have had one or more previous children and have consumed tea.

Regarding the use of complementary and alternative medicine in early pregnancy, the Irish study by Cleary et al. (2010) reported a 0.58% prevalence of use of herbal medicines and supplements. This very low prevalence in comparison to the current study (40.5%) may be due to the fact that only herbals were assessed while the present study assessed all categories of complementary and alternative medicines including herbals. Moreover, the authors did not document the type of herbal products reportedly used by respondents. The discrepancy could also be explained by the differences in culture of the pregnant populations of the UK and the Republic of Ireland. In addition, the current study found that complementary and alternative medicine users were more likely to be between 31 and 40 years and university-educated.

In the case of alcohol consumption in early pregnancy, a US work by Harrison and Sidebottom (2009) reported a prevalence of 5.6%. The low prevalence compared to the present study of 11.4% could be due to the fact that in the previous study, data collection was carried out as part of a

federally-funded 'Healthy Start Initiative' which aimed to reduce infant mortality and other poor birth outcomes. Hence, it is possible that the pregnant women were aware of this initiative and its objectives. The comparatively low prevalence is therefore suggestive that some participants may have failed to disclose alcohol consumption in the first trimester in order not to feel guilty. Another reason for the low prevalence of alcohol use could be because the study sample was quite young, with more than two-thirds of the respondents being ≤ 24 years old. In the current study, users of alcohol were more likely to be in the age group of 31-40 years and have consumed tea.

Internationally, there are no comparable studies for the prevalence of cigarette smoking and illicit substance use in early pregnancy which employed the same methods as the current study. In the US research by Hayes et al. (2002), which used medical record review as the data collection method, it was reported that 42% of the women smoked cigarettes in early pregnancy. In comparison, the present study found that 3.0% (17/560) of participants had smoked cigarettes. It is important to note that the previous study was carried out on a predominantly low-income, Caucasians in a rural area with most of the participants (70.3%) being less than 26 years old. This in addition to the data collection method employed, might have accounted for the differences in the prevalence of cigarette smoking in the first trimester between the two countries. Furthermore, the study was carried out over a decade ago and there could have been increased awareness amongst pregnant women of the risks associated with cigarette smoking during pregnancy which could help reduce consumption. In the present study, the

women who smoked were more likely to have lower education (below university level) and more likely to have consumed coffee.

As regards illicit substance use in the first trimester, in a UK study by Fergusson et al. (2002), participants filled self-completed postal questionnaires in the second trimester about their substance use and it was discovered that 2.3% of the women had consumed cannabis in pregnancy. The reported prevalence of the only illicit substance found in the present study- cannabis- was very low (0.4%) because only 2 out of 560 women disclosed prenatal use. The much lower prevalence in the present study could be due either to recall problems or the decision by the participants not to admit use because of the face-to-face data collection method used. Therefore, the prevalence of exposure may have been under-estimated. The under-reporting of illicit substances by pregnant women is, however not surprising, and has been previously described in some studies (Hingson et al., 1986; Day and Richardson, 1991; Pegues et al., 1994; Lester et al., 2001; Pichini et al., 2005; Lozano et al., 2007). Women's reluctance to admit the use of illicit substances may also be due to shame, guilt, and fear of having their children taken away from them into care (Koren et al., 2002).

A notable result of the current study which was not previously assessed in prior researches is the safety knowledge of expectant mothers about medicine and recreational substance use in the antenatal period. It was discovered that although a high proportion of the women felt they had enough information on the safety of recreational substances (licit and illicit), a substantial number of them believed they had little or no information about the safety of medicines (prescription, over-the-counter and complementary

and alternative medicines) in pregnancy. Thus, the belief that they had insufficient safety knowledge about medicines could influence their decisions positively or negatively when considering prenatal use of these agents.

2.7.2 Prospective cohort study

This study describes medicine and recreational substance use before pregnancy, and in the first, second and third trimesters of pregnancy as well as the pregnancy outcomes in a cohort of women. It is the first UK study to prospectively examine exposures to all medicines and recreational substances across all trimesters using a structured interview approach and this helped to reduce the effect of recall bias on prevalence estimates.

Prescription medicine use was 30.8% in the 3 months before pregnancy and this decreased to 9.5% in the third trimester. Over-the-counter medicines which had a prevalence of 52.7% before pregnancy, decreased to 25.1% in the second trimester but increased to 40.3% in the third trimester. The proportion of complementary and alternative medicine users was 32.7% prior to pregnancy and this increased to 49.8% in the third trimester.

Alcohol and cigarette had prevalence of 69.2% and 13.2% before pregnancy respectively. These reduced to 11.4% and 2.4% in the first trimester but increased slightly in the second and third trimesters for alcohol and cigarette respectively. A reduction in the percentages of participants who admitted to the use of illicit substances in pregnancy was found compared to before pregnancy (Table 15).

With regard to the pregnancy outcomes, concomitant use of complementary and alternative medicines with cigarette in the first trimester was univariably

associated with an increased risk of congenital anomaly in the baby (p = 0.001). The use of complementary and alternative medicines jointly with over-the-counter medicines in at least one trimester was also univariably associated with a higher risk of congenital anomaly in the baby (p = 0.001). Comparable results on concomitant use of these agents and associations with pregnancy outcomes were not found in previous international studies. However, due to the limited sample size of the cohort, logistic regression could not be carried out to control for potential confounders. Hence, the results should be regarded as preliminary and further investigation is necessary.

2.7.3 Strengths and Limitations

The findings from this study need to be viewed in the context of some limitations. The sample size of the cohort was limited, thus the statistical analyses examined the effects of medicines and recreational substances on pregnancy outcomes univariably using the chi-square test; confounders were not controlled for. Furthermore, the analysis of the effects of complementary and alternative medicines on pregnancy outcomes was not stratified into ingested or physical therapies.

Despite these limitations, the study approach has reduced the effect of poor recall or recall bias on prevalence estimates as previous work suggest that women interviewed post-natally have poorer recall of antenatal information than women interviewed antenatally (Bryant et al., 1989), hence a major strength of the current study is the fact that women were interviewed in the antenatal period to ascertain medicine and recreational substance exposure. Additionally, the exposure information about medicines and recreational

substances was prospective in relation to the pregnancy outcomes, thus it is unlikely that ascertainment was dependent on the outcome, which is the case in retrospective studies (Cleary et al., 2010). Therefore, the accuracy of the data was enhanced.

Interviewing participants with a questionnaire also allowed participants to ask clarifying questions and helped to avoid missing variables, thereby enhancing more complete answers. Furthermore, interviewing participants directly also helped to gather information on complementary and alternative medicines which are not usually documented in databases.

2.8 Conclusions

This study indicates that the use of medicines (prescription, over-the-counter, complementary and alternative medicines) was reportedly more common than recreational substances (licit and illicit) during pregnancy. Furthermore, the study could not show an association between the medicines and recreational substances used during pregnancy and increased risk of congenital anomalies in the baby. However, a considerable number of the participants believed they had little or no information about the safety of medicines in pregnancy. In addition to the risks associated with foetal exposure to medicines and recreational substances, there are risks associated with women's inadequate or lack of information regarding safety. Therefore, an area for further research which has emerged from this study is that of women's beliefs about the use of medicines and recreational substances during pregnancy. This issue provides the implications for the second part of this thesis. The next two chapters investigate the health

beliefs, attitudes and knowledge of expectant mothers with respect to medicine and recreational substance use during pregnancy.

CHAPTER 3 - HEALTH BELIEFS, ATTITUDES AND KNOWLEDGE OF EXPECTANT MOTHERS REGARDING MEDICINE AND RECREATIONAL SUBSTANCE USE IN PREGNANCY – A NARRATIVE LITERATURE REVIEW

3.1 Introduction

The beliefs and attitudes of expectant mothers influence whether or not they will use medicines and their conformation to healthy behaviours (Rosenblatt, 1998). Health beliefs are defined as “the personal convictions that influence health behaviours” (Anderson et al., 2002) and individuals’ health beliefs and risk perceptions are significant predictors of health-related behaviours (Brown and Morley, 2007; Kaptein et al., 2007). An attitude is “a relatively enduring organisation of beliefs, feelings, and behavioural tendencies towards socially significant objects, groups, events or symbols” (Hogg and Vaughan, 2005).

Pregnant women are of special interest in terms of medicine and recreational substance use. Studies have found evidence on the importance of beliefs and attitudes in determining whether or not pregnant women perform recommended health actions, such as folic acid intake (Tinsley, 1993; Haslam et al., 2003). The beliefs of pregnant women can also influence their decision on whether to use a medicine or not, especially when considering over-the-counter or complementary and alternative medicines.

In the case of prescribed medicines, a woman’s beliefs or attitudes may affect adherence to the doctor’s prescription (Nordeng et al., 2010b). Some studies have shown that most expectant mothers have an unrealistic fear of medicines (Koren et al., 1989; Sanz et al., 2001; Einarson, 2007; Nordeng et al., 2010b), and that wrong perception of risk can affect health behaviour (Koren and Pastuszak 1990; Baggley et al., 2004). This is because a woman may perceive the risk of taking a medicine during pregnancy to be higher than the actual risk and as a result may compromise her health or that of the

unborn child by discontinuing needed medicines or terminating a pregnancy (Koren et al., 1989; Sanz et al., 2001; Einarson, 2007). This issue is especially important for many medicines which are used in the treatment of medical conditions such as hypertension, which if left untreated, may be more harmful than the prescribed medicine to both the mother and foetus. Therefore, there could be serious health consequences if the expectant mothers' attitudes affect adherence to needed medicines in a negative way (Nordeng et al., 2010a).

Other studies have documented the role of beliefs in behaviours of medical concern such as prenatal smoking (Lawson 1994; Haslam and Lawrence 2004). It has also been reported that women have differing attitudes about the risk associated with drinking alcohol and this influenced their consumption during pregnancy (Raymond et al., 2009). This is because information about the potentially harmful effects of alcohol during pregnancy does not necessarily equate to understanding while information and knowledge may not be associated with pregnant women's attitudes toward drinking (Kesmodel and Kesmodel 2002).

Given the foregoing, it is important to recognise and understand the common health beliefs, attitudes and knowledge in this population and to identify the gaps in the international literatures.

3.2 Aim

To conduct a narrative literature review on the health beliefs, attitudes and knowledge of pregnant women with respect to medicine (prescription, over-

the-counter and complementary and alternative medicines) and recreational substance (licit and illicit) use in pregnancy.

3.3 Methods

3.3.1 Databases

The databases that were searched for articles which focus on health beliefs, attitudes and knowledge about medicine and recreational substance use in pregnancy are: PubMed (1950 to October 2012), EMBASE (1980 to 2012 Week 46), International Pharmaceutical Abstracts (1970 to October 2012) and CINAHL Plus (1937 to November 2012). In addition to these, the reference lists of the relevant articles were searched for other relevant publications. This search was carried out again in August 2013 but no new relevant article was found.

3.3.2 Search strategy and terms

Prescription drugs OR prescription medicines OR prescription medications OR over-the-counter drugs OR over-the-counter medicines OR over-the-counter medications OR herbal medicines OR herbal products OR herbal remedies OR herbal therapy OR herbal preparations OR complementary medicines OR complementary therapy OR alternative medicines OR alternative therapy OR traditional medicines OR traditional remedies OR phytotherapy OR phytomedicines OR botanicals OR botanical products OR alcohol OR ethanol OR cigarette OR tobacco OR cigar OR licit drugs OR illicit drugs OR illegal drugs OR recreational drugs OR social drugs OR drugs of abuse OR substance use OR substance abuse OR substance misuse

AND

Pregnant OR pregnancy OR pregnant woman OR pregnant women OR gestation OR gestational OR prenatal OR antenatal OR maternal

AND

Health belief OR health beliefs OR health practice OR health practices OR health value OR health values OR health behaviour OR health behaviours OR health norm OR health norms OR health culture OR health cultures OR health attitude OR health attitudes OR health tradition OR health traditions OR health view OR health views OR health opinion OR health opinions OR health perception OR health perceptions OR health conviction OR health convictions OR health idea OR health ideas OR health action OR health actions OR health activity OR health activities OR health knowledge OR health information

3.3.3 Inclusion criteria

Original studies (qualitative and quantitative) written in English language reporting health beliefs, attitudes and knowledge about the use of medicines and recreational substances in pregnancy were included. Of interest in this review are prescription medicines, over-the-counter medicines, complementary and alternative medicines and recreational substances (licit and illicit substances).

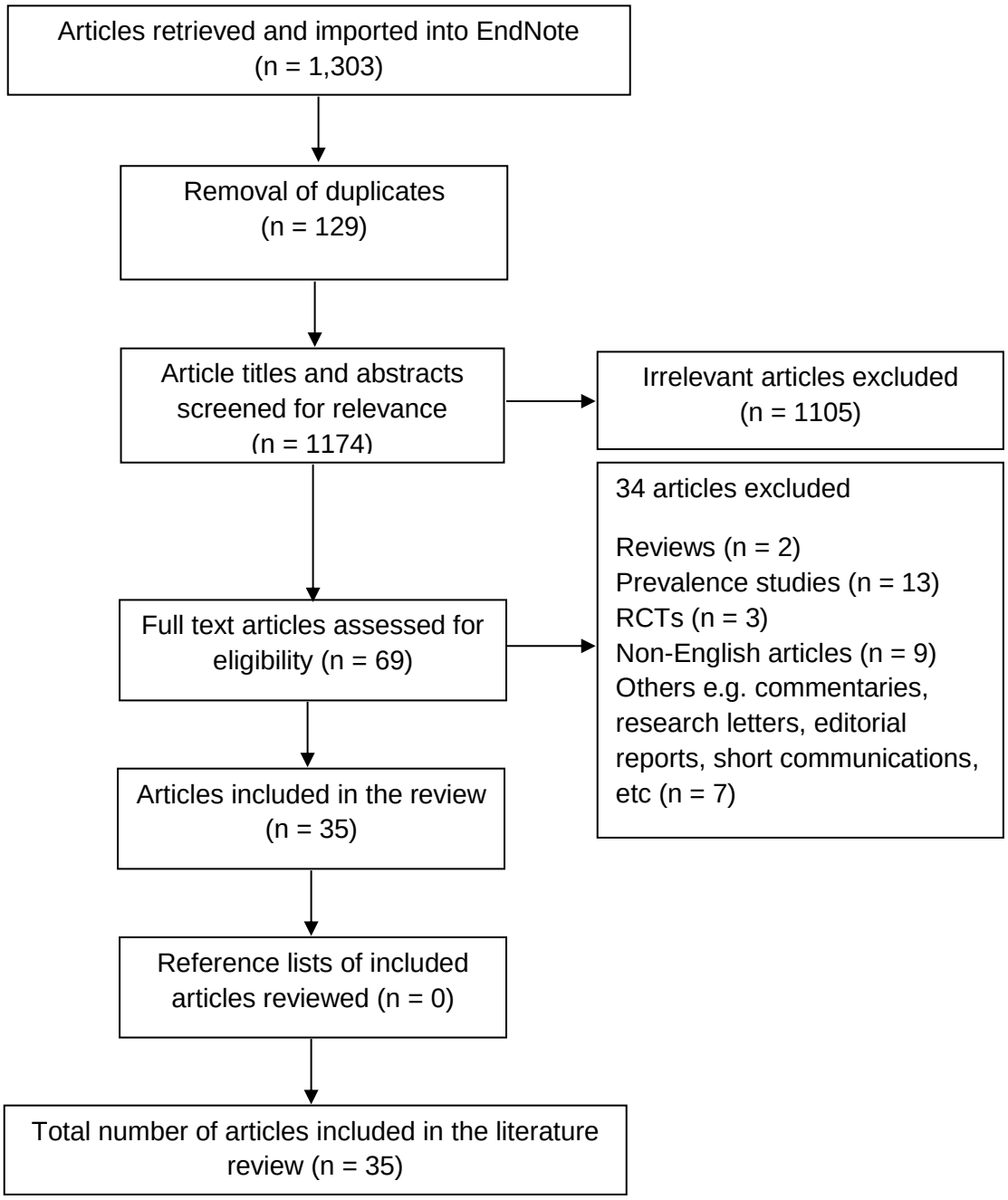

Figure 10 Review flow chart

3.4 Results

The electronic search produced 1303 articles – 638 from PubMed, 185 from EMBASE, 478 from CINAHL plus and 2 from International Pharmaceutical Abstracts. A total of 35 articles reporting 27 quantitative and 8 qualitative studies met the inclusion criteria (Table 17). However, there are disparities

amongst the articles because of the differences in data collection methods, study objectives, sample sizes and study participants (pregnant or postpartum women). The studies also focused on different medicines and recreational substances of interest – Complementary and alternative medicines (n = 7), Alcohol (n = 17), Tobacco (n = 14), Illicit substances (n = 1), Over-the-counter medicines (n = 5), and Prescription medicines (n = 2). Some of the articles studied more than one medicine or recreational substance. The papers were from Ghana (n = 1), Dominican republic (n = 1), United States (n = 5), United Kingdom (n = 5), Lebanon (n = 1), Zambia and Democratic Republic of Congo (n = 1), Ireland (n = 1), Japan (n = 1), South Africa (n = 1), Canada (n = 1), Nigeria (n = 1), Australia (n = 2), Brazil (n = 1), Turkey (n = 1), Denmark (n = 1), Korea (n = 1), Papua New Guinea (n = 1), Czech Republic (n = 1), Italy (n = 1), France (n = 2), Finland (n = 1), Honduras (n = 1), Norway (n = 2) and Israel (n = 1).

Table 17 Articles included in the review

Author	Year	Country	Objectives	Methods		Population characteristics		Medicine/Substance studied	Major findings
				Theoretical framework	Data collection	Sample size	Study participants		
Baric and MacArthur	1977	United Kingdom	Develop a method of measuring social expectations (norms) and to find out how far pregnant women conform in their behaviour to the norms	None	Quantitative (Interview with questionnaire)	*n* = 243	Pregnant and postpartum women	Cigarette, alcohol and over-the-counter medication	39% of the women thought that a pregnant woman was not expected to smoke at all while 40% thought that pregnant women were expected to reduce the number of cigarettes smoked. Fifty one percent (51%) of the women felt pregnant women should reduce their drinking or to drink only small amounts of alcohol; 8% felt they were expected to stop taking alcohol completely; 7% believed that there was a beneficial effect in drinking stout during pregnancy. Seventy-five percent (75%) thought that a pregnant woman should not take any medicines without first consulting a doctor.
Barbour	1990	USA	Explore the drinking behaviours of pregnant women and factors influencing the behaviours	None	Qualitative (Interview)	*n* = 20	Pregnant women	Alcohol	19 of the women knew about the dangers of alcohol in pregnancy; many of them believed that wine or beer is not as bad as other forms of alcohol and that alcohol can only cause problems in early pregnancy; they also believed that it is dangerous to the foetus only if large amounts are consumed.

Table 17 Articles included in the review (continued)

Butters and Howie	1990	United Kingdom	Assess the attitudes and knowledge among pregnant women of the effects of commonly used drugs, cigarette and alcohol on the foetus	None	Quantitative (Self-administered questionnaire)	*n* = 514	Postpartum women	Precription and Over-the-counter medicines, Cigarette and Alcohol	85% of the women recognised that the foetus is most at risk of being harmed by drugs during the first 3 months of pregnancy; 83% felt it was safest not to smoke any cigarettes at all during pregnancy; 88% were aware of the adverse effects of smoking on foetal growth; 55% thought that alcohol should be avoided during pregnancy while 28% considered it safe to consume one drink a week. 51% thought that drinking alcohol in pregnancy could result in growth retardation and 66% thought it could cause foetal abnormalities. 49% said they would take an antibiotic prescribed by the doctor while 48% said they would not. 16% would avoid taking any form of analgesia during pregnancy.
Daly et al	1992	Ireland	Establish the level of alcohol and cigarette consumption and the level of knowledge of potential adverse effects	None	Quantitative (Interview with questionnaire)	*n* = 100	Postpartum women	Alcohol and Cigarette	58% of the women were aware of the harmful effects of alcohol during pregnancy; 93% were aware of the harmful effects of smoking during pregnancy.
Dow-Clarke et al	1994	Canada	Assess the health behaviours of pregnant women	None	Quantitative (Questionnaire)	*n* = 173	Pregnant women	Over-the-counter medications and alcohol	92.4% of the women agreed with the statement that non-prescription medications should be avoided during pregnancy. In terms of alcohol, 43.4% agreed with the statement that it is okay to drink occasionally during pregnancy while 48% disagreed with this statement.

Table 17 Articles included in the review (continued)

Lawson	1994	USA	Examine the role of cigarette smoking in the lives of pregnant adolescents	None	Qualitative (In-depth interview)	*n* = 20	Pregnant adolescents	Cigarette	The respondents believed that cigarette smoking controlled body weight and that cessation consistently produced marked weight gain. They also believed that cigarette smoking would assure having a smaller baby which would result in a shorter labour and less painful delivery.
Lelong et al	1995	France	Investigate the attitudes and behaviour of pregnant women towards tobacco and alcohol consumption	None	Quantitative (Interview with a structured questionnaire)	*n* = 176	Pregnant and postpartum women	Alcohol and Tobacco	Most women were aware that alcohol and tobacco could be harmful to their babies but heavy drinkers recognised the influence of alcohol in pregnancy less often than the others. Sixty percent (60%) of the women thought that two drinks per day was a reasonable level of consumption during pregnancy.
Steyn et al	1997	South Africa	Estimate exposure to active and passive smoking of pregnant women and to determine their knowledge and behaviour about smoking during pregnancy	None	Quantitative (Self-administered questionnaire)	*n* = 394	Pregnant women	Tobacco	88.8% of the women believed that smoking is bad for the mother's health; 92.1% believed that smoking is bad for the unborn baby's health.
Kaskutas	2000	USA	Examine pregnant women's drinking during pregnancy and their beliefs about the risks	None	Qualitative (Interview)	*n* = 321	Pregnant women	Alcohol	17% of the women believed that there is a point in pregnancy when it is too late to reduce one's drinking. In terms of comparative safety, 26% of beer drinkers said beer is safer; 31% of wine drinkers felt wine is safer; 26% of wine cooler drinkers said wine cooler is safer.
Kesmodel and Kesmodel	2002	Denmark	Assess the attitudes toward and beliefs and knowledge of pregnant women about drinking during pregnancy	None	Quantitative (Interview with questionnaire)	*n* = 439	Pregnant women	Alcohol	76% of the women considered some alcohol intake during pregnancy to be acceptable, mostly on a weekly basis; 85% believed that binge drinking was potentially harmful to the foetus.

Table 17 Articles included in the review (continued)

Chaaya et al	2004	Lebanon	Assess pregnant women's knowledge of the chemical contents and harmful effects of cigarettes and argileh, their attitudes towards smoking and their smoking habits before and during pregnancy	None	Quantitative (Interview with a questionnaire)	*n* = 864	Pregnant women	Cigarette	68.7% of the pregnant women were aware that cigarette contains addictive substances; 69% knew it contains carcinogens; 78.4% knew it affects the foetus; 76.8% knew that cigarette affects the newborn
Gaffney and Smith	2004	Australia	Examine women's views towards the use of complementary and alternative medicines (CAM) during pregnancy	None	Quantitative (Interview with questionnaire)	*n* = 220	Pregnant women	Complementary and alternative medicines	Majority of the women considered the use of CAM to be safe during pregnancy. 36.4% agreed with the statement "I believe complementary therapy to be more effective for my problem than conventional medicine"; 50% agreed with the statement "I feel that complementary treatment is a more natural form of healing than conventional medicine"; 52.3% agreed with the statement "I believe that CAM enables me to take a more active part in maintaining my health"; 11.4% agreed with the statement "I have a more equal relationship with my complementary practitioner than with my doctor"; 61.4% agreed with the statement "I value the emphasis on treating the whole person".
Garcias and Schuler-Faccini	2004	Brazil	Investigate the beliefs of mothers regarding risk factors associated with congenital abnormalities	None	Quantitative (Interview with questionnaire)	*n* = 3219	Postpartum women	Tobacco and Alcohol	88.4% of the women believed that tobacco smoking can cause congenital defects; 88.8% believed that alcohol consumption can cause congenital abnormalities.

Table 17 Articles included in the review (continued)

Griffiths et al	2005	United Kingdom	Assess pregnant women's knowledge of foetal and maternal risk of smoking and to determine the motivators for smoking cessation	None	Quantitative (Interview with a questionnaire)	*n* = 145	Pregnant women	Tobacco	92% of the women were aware that smoking can cause lung cancer; 76% knew it can cause myocardial infarction; 50% knew it can cause miscarriage; 34% were aware it can cause ante-partum haemorrhage; 44% knew it can cause decreased birth weight; 33% knew it can cause slower cognitive development; 38% were aware it can lead to cot death.
Kralikova et al	2005	Czech Republic	Investigate information about smoking impact on pregnancy	None	Quantitative (Structured interview)	*n* = 265	Postpartum women	Cigarette	Most of the women had insufficient information about the impact of smoking on the baby.
Nordeng and Havnen	2005	Norway	Investigate the impact of socio-demographic factors, knowledge and attitude on the use of herbal drugs in pregnancy	None	Quantitative (Interview with a structured questionnaire)	*n* = 400	Postpartum women	Herbal medicines	62.3% of the women agreed that herbal drugs generally give less adverse effects than conventional drugs; 57% expressed that herbal drugs can be used by pregnant women; 40.8% believed that pregnant women should preferably use herbal drugs than other drugs and 56.5% agreed that pregnant women should not use herbal drugs without the consent of the physician
Chang et al	2006	USA	Assess the knowledge of pregnant women about alcohol use	None	Quantitative (Self-completed questionnaire)	*n* = 254	Pregnant women	Alcohol	79.9% of the women were correct that there is no universally safe level of prenatal alcohol use; 94% were correct that alcohol exposure may have negative effects throughout pregnancy.
Milla et al	2007	Honduras	Determine the knowledge, attitudes, and practices related to folic acid and birth defects among postpartum women	None	Quantitative (Interview with questionnaire)	*n* = 2619	Postpartum women	Over-the-counter medicine - Folic acid	37.6% of the women were aware that folic acid helped to avoid birth defects and was good for the growth and development of the baby; 24.1% felt folic acid was a vitamin or was related to anaemia or iron; 7.8% thought folic acid was good for health in general.

Table 17 Articles included in the review (continued)

Lapi et al	2008	Italy	Explore pregnant women's use, attitudes, knowledge and beliefs of complementary and alternative drugs	None	Quantitative (Interview with semi-structured questionnaire)	*n* = 172	Pregnant women	Complementary and alternative drugs	52% of the women were convinced that complementary and alternative drugs are safer than conventional medications while 62.7% considered them as having equal efficacy as conventional drugs.
Yamamoto et al	2008	Japan	Examine alcohol consumption and abstention among pregnant women	None	Quantitative (Self-administered questionnaire)	*n* = 14 239	Pregnant women	Alcohol	72.8% of the women had knowledge regarding the risks of alcohol consumption during pregnancy
Fakeye et al	2009	Nigeria	Determine the attitude and use of herbal medicines among pregnant women	None	Quantitative (Structured questionnaire)	*n* = 595	Pregnant women	Herbal medicines	33.4% of the participants felt herbal medicines were safe; 81% believed in the efficacy of herbal medicines
Holst et al	2009	United Kingdom	Determine the motivations for the use of herbal medicine during pregnancy	None	Qualitative (Focus group discussion)	*n* = 6	Pregnant women	Herbal medicines	The women were aware of the fact that nothing is absolutely safe but they believed that herbs are safer than pharmaceuticals. They also knew that interactions of herbals with pharmaceuticals could occur.
Karcaaltincaba et al	2009	Turkey	Investigate the level of knowledge about the effects of cigarette smoking and status before and during pregnancy	None	Quantitative (Interview with a questionnaire)	*n* = 1020	Pregnant women	Cigarette	97.5% of the women knew smoking was harmful; 62.5% were aware of at least three hazardous effects.
Raymond et al	2009	United Kingdom	Explore pregnant women's attitudes towards drinking alcohol in pregnancy and their attitudes towards sources of information about drinking in pregnancy	None	Qualitative (Telephone interview)	*n* = 20	Pregnant women	Alcohol	Most women considered that there were risks involved with drinking during pregnancy.
Senn et al	2009	Papua New Guinea	Investigate the habits of betel nut chewing and possible impact on pregnancy	None	Quantitative (Semi-structured questionnaire)	*n* = 310	Pregnant women	Recreational substance - Betel nut	80% of the women perceived no risk in using betel nut during pregnancy for the foetus.

Table 17 Articles included in the review (continued)

Bercaw et al	2010	USA	Investigate the use of herbs, vitamins, over-the-counter and prescription medications among Hispanic women	None	Quantitative (Self-administered questionnaire)	*n* = 485	Postpartum women	Herbs and vitamins	22% of the women believed that herbs and vitamins are safer to use than prescription medication; 20% believed that herbs are better at treating medical problems than prescription medication; 50% agreed that they would use herbs if given information about these by a doctor.
Chomba et al	2010	Zambia and Democratic Republic of Congo	Assess pregnant women's knowledge, attitudes and behaviours towards tobacco use and secondhand smoke exposure, and exposure to advertising for and against tobacco products	None	Quantitative (Face-to-face survey)	*n* = 1756	Pregnant women	Tobacco	86.5% thought cigarette smoking during pregnancy can harm the baby; 96.8% felt cigarette smoking can harm a woman's health
Nordeng et al	2010	Norway	Investigate pregnant women's beliefs about medication and the factors that determine those beliefs	None	Quantitative (Self-completed structured questionnaire on the internet)	*n* = 866	Pregnant women	Prescription medications and herbal remedies	87.4% agreed with the statement that they were more cautious about using medications when they are pregnant; 12.1% agreed that natural remedies can generally be used by pregnant women; 22.9% agreed that natural remedies are safer than conventional medicines; 13.2% agreed that pregnant women should preferably use natural remedies during pregnancy and 69.6% believed that pregnant women should not use natural remedies without the consent of a doctor
Toutain	2010	France	Determine what the women in France say about alcohol abstinence during pregnancy	None	Qualitative (Internet discussion)	*n* = 42	Pregnant women	Alcohol	80% mentioned alcohol abstinence; 20% talked about the consequences of drinking on the unborn babies. However, the concept of abstinence tends to be misunderstood because for most of them, abstinence was not perceived as "not drinking at all" while little is known about the consequences of alcohol consumption for the unborn babies

Table 17 Articles included in the review (continued)

Kim and Park	2011	Korea	Investigate prenatal alcohol consumption and knowledge of alcohol risks and foetal alcohol syndrome among Korean women	None	Quantitative (Self-completed questionnaire)	*n* = 221	Postpartum women	Alcohol	The knowledge level regarding alcohol risks and foetal alcohol syndrome among participants was poor.
Senecky et al	2011	Israel	Evaluate the awareness and knowledge of women regarding alcohol consumption during pregnancy; determine how many women received information about alcohol consumption from medical professionals; and to evaluate the drinking habits of the women during pregnancy	None	Quantitative (Questionnaire)	*n* = 3815	Postpartum women	Alcohol	71.6% claimed that women should not consume alcohol at all during pregnancy; 21.4% thought it was permissible if limited to 2 drinks per week
Torres et al	2011	Dominican Republic	Assess the attitudes, beliefs, perceptions, and practices regarding tobacco use and exposure among pregnant women	None	Quantitative (Interview with questionnaire)	*n* = 192	Pregnant women	Tobacco	97% believed women who smoke can harm their health; 98% believed pregnant women who smoke can harm their unborn baby's health; 33% believed tobacco use could cause general illness; 15% believed it could cause cancer and 1% believed it can lead to death.
Adusi-Poku et al	2012	Ghana	Determine the the magnitude of drinking and to assess the general knowledge about the effects of alcohol in pregnancy	None	Quantitative (Structured questionnaire)	*n* = 397	Pregnant women	Alcohol	78% of the women said alcohol could be harmful.
Jones and Telenta	2012	Australia	Explore attitudes towards alcohol consumption during pregnancy	None	Qualitative (Semi-structured interview)	*n* = 12	Pregnant women	Alcohol	All the women believed there were no benefits to drinking alcohol while pregnant and that not drinking was the best option. Majority of them expressed a lack of knowledge of the actual risks of alcohol consumption on the foetus.
Leppo	2012	Finland	Investigate the perception of pregnant women about the risks involved in prenatal illicit drug use.	None	Qualitative (Semi-structured interview)	*n* = 14	Pregnant and postpartum women	Illicit drug - Buprenorphine	The women were not primarily concerned about the health risks of illicit drugs; their greatest fears were giving birth to a child with withdrawal symptoms; they did not see abstaining from drugs as a risk-free option.

3.4.1 Data collection methods employed by the studies

Out of the 35 articles included in this review, 27 were quantitative while 8 were qualitative studies.

In the 27 quantitative studies, participants were either interviewed with a questionnaire or self-administered the questionnaires. Only Nordeng et al. (2010a) employed self-administered internet questionnaire (Table 18). The quantitative studies consist of 2 articles on prescription medicines (Butters and Howie, 1990; Nordeng et al., 2010a), 5 on over-the-counter medicines (Baric and MacArthur, 1977; Butters and Howie, 1990; Dow-Clarke et al., 1994; Milla et al., 2007; Bercaw et al., 2010), 6 on complementary and alternative medicines (Gaffney and Smith, 2004; Nordeng and Havnen, 2005; Lapi et al., 2008; Fakeye et al., 2009; Bercaw et al., 2010; Nordeng et al., 2010a), 12 on alcohol (Baric and MacArthur, 1977; Butters and Howie, 1990; Daly et al., 1992; Dow-Clarke et al., 1994; Lelong et al., 1995; Kesmodel and Kesmodel, 2002; Garcias and Schuler-Faccini, 2004; Chang et al., 2006; Yamamoto et al., 2008; Kim and Park, 2011; Senecky et al., 2011; Adusi-Poku et al., 2012) and 13 papers on tobacco (Baric and MacArthur, 1977; Butters and Howie, 1990; Daly et al., 1992; Lelong et al., 1995; Steyn et al., 1997; Chaaya et al., 2004; Garcias and Schuler-Faccini, 2004; Griffiths et al., 2005; Kralikova et al., 2005; Karcaaltincaba et al., 2009; Senn et al., 2009; Chomba et al., 2010; Torres et al., 2011).

The different approaches employed by the 8 qualitative studies were focus group discussion, face-to-face individual interview, telephone interview and internet discussion (Table 19). The studies reported on complementary and alternative medicines (Holst et al., 2009b), tobacco (Lawson, 1994), illicit

substance (Leppo, 2012) and alcohol (Barbour, 1990; Kaskutas, 2000; Raymond et al., 2009; Toutain, 2010; Jones and Telenta, 2012). There were no qualitative studies on prescription and over-the-counter medicines.

Majority of the reviewed articles assessed only health beliefs and attitudes (e.g Leppo, 2012), or only knowledge (e.g Kim and Park, 2011) while only 6 papers (Barbour, 1990; Butters and Howie, 1990; Lelong et al., 1995; Milla et al., 2007; Holst et al., 2009b; Jones and Telenta, 2012) studied all the factors of interest - health beliefs, attitudes and knowledge (Table 20). These 6 articles were made up of 3 quantitative and 3 qualitative studies and reported on alcohol (n = 3), tobacco (n = 1), prescription medicine (n = 1), over-the-counter medicine (n = 1) and complementary and alternative medicine (n = 1).

Table 18 Studies which employed quantitative data collection methods

Author	Year	Country	Objectives	Methods		Population characteristics		Medicine/Substance studied	Major findings
				Theoretical framework	Data collection	Sample size	Study participants		
Baric and MacArthur	1977	United Kingdom	Develop a method of measuring social expectations (norms) and to find out how far pregnant women conform in their behaviour to the norms	None	Quantitative (Interview with questionnaire)	*n* = 243	Pregnant and postpartum women	Cigarette, alcohol and over-the-counter medication	39% of the women thought that a pregnant woman was not expected to smoke at all while 40% thought that pregnant women were expected to reduce the number of cigarettes smoked. Fifty one percent (51%) of the women felt pregnant women should reduce their drinking or to drink only small amounts of alcohol; 8% felt they were expected to stop taking alcohol completely; 7% believed that there was a beneficial effect in drinking stout during pregnancy. Seventy-five percent (75%) thought that a pregnant woman should not take any medicines without first consulting a doctor.
Butters and Howie	1990	United Kingdom	Assess the attitudes and knowledge among pregnant women of the effects of commonly used drugs, cigarette and alcohol on the foetus	None	Quantitative (Self-administered questionnaire)	*n* = 514	Postpartum women	Precription and Over-the-counter medicines, Cigarette and Alcohol	85% of the women recognised that the foetus is most at risk of being harmed by drugs during the first 3 months of pregnancy; 83% felt it was safest not to smoke any cigarettes at all during pregnancy; 88% were aware of the adverse effects of smoking on foetal growth; 55% thought that alcohol should be avoided during pregnancy while 28% considered it safe to consume one drink a week. 51% thought that drinking alcohol in pregnancy could result in growth retardation and 66% thought it could cause foetal abnormalities. 49% said they would take an antibiotic prescribed by the doctor while 48% said they would not. 16% would avoid taking any form of analgesia during pregnancy.

Table 18 Studies which employed quantitative data collection methods (continued)

Daly et al	1992	Ireland	Establish the level of alcohol and cigarette consumption and the level of knowledge of potential adverse effects	None	Quantitative (Interview with questionnaire)	*n* = 100	Postpartum women	Alcohol and Cigarette	58% of the women were aware of the harmful effects of alcohol during pregnancy; 93% were aware of the harmful effects of smoking during pregnancy.
Dow-Clarke et al	1994	Canada	Assess the health behaviours of pregnant women	None	Quantitative (Questionnaire)	*n* = 173	Pregnant women	Over-the-counter medications and alcohol	92.4% of the women agreed with the statement that non-prescription medications should be avoided during pregnancy. In terms of alcohol, 43.4% agreed with the statement that it is okay to drink occasionally during pregnancy while 48% disagreed with this statement.
Lelong et al	1995	France	Investigate the attitudes and behaviour of pregnant women towards tobacco and alcohol consumption	None	Quantitative (Interview with a structured questionnaire)	*n* = 176	Pregnant and postpartum women	Alcohol and Tobacco	Most women were aware that alcohol and tobacco could be harmful to their babies but heavy drinkers recognised the influence of alcohol in pregnancy less often than the others. Sixty percent (60%) of the women thought that two drinks per day was a reasonable level of consumption during pregnancy.
Steyn et al	1997	South Africa	Estimate exposure to active and passive smoking of pregnant women and to determine their knowledge and behaviour about smoking during pregnancy	None	Quantitative (Self-administered questionnaire)	*n* = 394	Pregnant women	Tobacco	88.8% of the women believed that smoking is bad for the mother's health; 92.1% believed that smoking is bad for the unborn baby's health.
Kesmodel and Kesmodel	2002	Denmark	Assess the attitudes toward and beliefs and knowledge of pregnant women about drinking during pregnancy	None	Quantitative (Interview with questionnaire)	*n* = 439	Pregnant women	Alcohol	76% of the women considered some alcohol intake during pregnancy to be acceptable, mostly on a weekly basis; 85% believed that binge drinking was potentially harmful to the foetus.

Table 18 Studies which employed quantitative data collection methods (continued)

Gaffney and Smith	2004	Australia	Examine women's views towards the use of complementary and alternative medicines (CAM) during pregnancy	None	Quantitative (Interview with questionnaire)	*n* = 220	Pregnant women	Complementary and alternative medicines	Majority of the women considered the use of CAM to be safe during pregnancy. 36.4% agreed with the statement "I believe complementary therapy to be more effective for my problem than conventional medicine"; 50% agreed with the statement "I feel that complementary treatment is a more natural form of healing than conventional medicine"; 52.3% agreed with the statement "I believe that CAM enables me to take a more active part in maintaining my health"; 11.4% agreed with the statement "I have a more equal relationship with my complementary practitioner than with my doctor"; 61.4% agreed with the statement "I value the emphasis on treating the whole person".
Garcias and Schuler-Faccini	2004	Brazil	Investigate the beliefs of mothers regarding risk factors associated with congenital abnormalities	None	Quantitative (Interview with questionnaire)	*n* = 3219	Postpartum women	Tobacco and Alcohol	88.4% of the women believed that tobacco smoking can cause congenital defects; 88.8% believed that alcohol consumption can cause congenital abnormalities.
Chaaya et al	2004	Lebanon	Assess pregnant women's knowledge of the chemical contents and harmful effects of cigarettes and argileh, their attitudes towards smoking and their smoking habits before and during pregnancy	None	Quantitative (Interview with a questionnaire)	*n* = 864	Pregnant women	Cigarette	68.7% of the pregnant women were aware that cigarette contains addictive substances; 69% knew it contains carcinogens; 78.4% knew it affects the foetus; 76.8% knew that cigarette affects the newborn
Kralikova et al	2005	Czech Republic	Investigate information about smoking impact on pregnancy	None	Quantitative (Structured interview)	*n* = 265	Postpartum women	Cigarette	Most of the women had insufficient information about the impact of smoking on the baby.

Table 18 Studies which employed quantitative data collection methods (continued)

Nordeng and Havnen	2005	Norway	Investigate the impact of socio-demographic factors, knowledge and attitude on the use of herbal drugs in pregnancy	None	Quantitative (Interview with a structured questionnaire)	*n* = 400	Postpartum women	Herbal medicines	62.3% of the women agreed that herbal drugs generally give less adverse effects than conventional drugs; 57% expressed that herbal drugs can be used by pregnant women; 40.8% believed that pregnant women should preferably use herbal drugs than other drugs and 56.5% agreed that pregnant women should not use herbal drugs without the consent of the physician
Griffiths et al	2005	United Kingdom	Assess pregnant women's knowledge of foetal and maternal risk of smoking and to determine the motivators for smoking cessation	None	Quantitative (Interview with a questionnaire)	*n* = 145	Pregnant women	Tobacco	92% of the women were aware that smoking can cause lung cancer; 76% knew it can cause myocardial infarction; 50% knew it can cause miscarriage; 34% were aware it can cause ante-partum haemorrhage; 44% knew it can cause decreased birth weight; 33% knew it can cause slower cognitive development; 38% were aware it can lead to cot death.
Chang et al	2006	USA	Assess the knowledge of pregnant women about alcohol use	None	Quantitative (Self-completed questionnaire)	*n* = 254	Pregnant women	Alcohol	79.9% of the women were correct that there is no universally safe level of prenatal alcohol use; 94% were correct that alcohol exposure may have negative effects throughout pregnancy.
Milla et al	2007	Honduras	Determine the knowledge, attitudes, and practices related to folic acid and birth defects among postpartum women	None	Quantitative (Interview with questionnaire)	*n* = 2619	Postpartum women	Over-the-counter medicine - Folic acid	37.6% of the women were aware that folic acid helped to avoid birth defects and was good for the growth and development of the baby; 24.1% felt folic acid was a vitamin or was related to anaemia or iron; 7.8% thought folic acid was good for health in general.
Yamamoto et al	2008	Japan	Examine alcohol consumption and abstention among pregnant women	None	Quantitative (Self-administered questionnaire)	*n* = 14 239	Pregnant women	Alcohol	72.8% of the women had knowledge regarding the risks of alcohol consumption during pregnancy

Table 18 Studies which employed quantitative data collection methods (continued)

Lapi et al	2008	Italy	Explore pregnant women's use, attitudes, knowledge and beliefs of complementary and alternative drugs	None	Quantitative (Interview with semi-structured questionnaire)	*n* = 172	Pregnant women	Complementary and alternative drugs	52% of the women were convinced that complementary and alternative drugs are safer than conventional medications while 62.7% considered them as having equal efficacy as conventional drugs.
Fakeye et al	2009	Nigeria	Determine the attitude and use of herbal medicines among pregnant women	None	Quantitative (Structured questionnaire)	*n* = 595	Pregnant women	Herbal medicines	33.4% of the participants felt herbal medicines were safe; 81% believed in the efficacy of herbal medicines
Senn et al	2009	Papua New Guinea	Investigate the habits of betel nut chewing and possible impact on pregnancy	None	Quantitative (Semi-structured questionnaire)	*n* = 310	Pregnant women	Recreational substance - Betel nut	80% of the women perceived no risk in using betel nut during pregnancy for the foetus.
Karcaaltincaba et al	2009	Turkey	Investigate the level of knowledge about the effects of cigarette smoking and status before and during pregnancy	None	Quantitative (Interview with a questionnaire)	*n* = 1020	Pregnant women	Cigarette	97.5% of the women knew smoking was harmful; 62.5% were aware of at least three hazardous effects.
Nordeng et al	2010	Norway	Investigate pregnant women's beliefs about medication and the factors that determine those beliefs	None	Quantitative (Self-completed structured questionnaire on the internet)	*n* = 866	Pregnant women	Prescription medications and herbal remedies	87.4% agreed with the statement that they were more cautious about using medications when they are pregnant; 12.1% agreed that natural remedies can generally be used by pregnant women; 22.9% agreed that natural remedies are safer than conventional medicines; 13.2% agreed that pregnant women should preferably use natural remedies during pregnancy and 69.6% believed that pregnant women should not use natural remedies without the consent of a doctor
Bercaw et al	2010	USA	Investigate the use of herbs, vitamins, over-the-counter and prescription medications among Hispanic women	None	Quantitative (Self-administered questionnaire)	*n* = 485	Postpartum women	Herbs and vitamins	22% of the women believed that herbs and vitamins are safer to use than prescription medication; 20% believed that herbs are better at treating medical problems than prescription medication; 50% agreed that they would use herbs if given information about these by a doctor.

Table 18 Studies which employed quantitative data collection methods (continued)

Chomba et al	2010	Zambia and Democratic Republic of Congo	Assess pregnant women's knowledge, attitudes and behaviours towards tobacco use and secondhand smoke exposure, and exposure to advertising for and against tobacco products	None	Quantitative (Face-to-face survey)	*n* = 1756	Pregnant women	Tobacco	86.5% thought cigarette smoking during pregnancy can harm the baby; 96.8% felt cigarette smoking can harm a woman's health
Kim and Park	2011	Korea	Investigate prenatal alcohol consumption and knowledge of alcohol risks and foetal alcohol syndrome among Korean women	None	Quantitative (Self-completed questionnaire)	*n* = 221	Postpartum women	Alcohol	The knowledge level regarding alcohol risks and foetal alcohol syndrome among participants was poor.
Senecky et al	2011	Israel	Evaluate the awareness and knowledge of women regarding alcohol consumption during pregnancy; determine how many women received information about alcohol consumption from medical professionals; and to evaluate the drinking habits of the women during pregnancy	None	Quantitative (Questionnaire)	*n* = 3815	Postpartum women	Alcohol	71.6% claimed that women should not consume alcohol at all during pregnancy; 21.4% thought it was permissible if limited to 2 drinks per week
Torres et al	2011	Dominican Republic	Assess the attitudes, beliefs, perceptions, and practices regarding tobacco use and exposure among pregnant women	None	Quantitative (Interview with questionnaire)	*n* = 192	Pregnant women	Tobacco	97% believed women who smoke can harm their health; 98% believed pregnant women who smoke can harm their unborn baby's health; 33% believed tobacco use could cause general illness; 15% believed it could cause cancer and 1% believed it can lead to death.
Adusi-Poku et al	2012	Ghana	Determine the the magnitude of drinking and to assess the general knowledge about the effects of alcohol in pregnancy	None	Quantitative (Structured questionnaire)	*n* = 397	Pregnant women	Alcohol	78% of the women said alcohol could be harmful.

Table 19 Studies which employed qualitative data collection methods

Author	Year	Country	Objectives	Methods		Population characteristics		Medicine/Substance studied	Major findings
				Theoretical framework	Data collection	Sample size	Study participants		
Barbour	1990	USA	Explore the drinking behaviours of pregnant women and factors influencing the behaviours	None	Qualitative (Interview)	*n* = 20	Pregnant women	Alcohol	19 of the women knew about the dangers of alcohol in pregnancy; many of them believed that wine or beer is not as bad as other forms of alcohol and that alcohol can only cause problems in early pregnancy; they also believed that it is dangerous to the foetus only if large amounts are consumed.
Lawson	1994	USA	Examine the role of cigarette smoking in the lives of pregnant adolescents	None	Qualitative (In-depth interview)	*n* = 20	Pregnant adolescents	Cigarette	The respondents believed that cigarette smoking controlled body weight and that cessation consistently produced marked weight gain. They also believed that cigarette smoking would assure having a smaller baby which would result in a shorter labour and less painful delivery.
Kaskutas	2000	USA	Examine pregnant women's drinking during pregnancy and their beliefs about the risks	None	Qualitative (Interview)	*n* = 321	Pregnant women	Alcohol	17% of the women believed that there is a point in pregnancy when it is too late to reduce one's drinking. In terms of comparative safety, 26% of beer drinkers said beer is safer; 31% of wine drinkers felt wine is safer; 26% of wine cooler drinkers said wine cooler is safer.
Holst et al	2009	United Kingdom	Determine the motivations for the use of herbal medicine during pregnancy	None	Qualitative (Focus group discussion)	*n* = 6	Pregnant women	Herbal medicines	The women were aware of the fact that nothing is absolutely safe but they believed that herbs are safer than pharmaceuticals. They also knew that interactions of herbals with pharmaceuticals could occur.

Table 19 Studies which employed qualitative data collection methods (continued)

Raymond et al	2009	United Kingdom	Explore pregnant women's attitudes towards drinking alcohol in pregnancy and their attitudes towards sources of information about drinking in pregnancy	None	Qualitative (Telephone interview)	*n* = 20	Pregnant women	Alcohol	Most women considered that there were risks involved with drinking during pregnancy.
Toutain	2010	France	Determine what the women in France say about alcohol abstinence during pregnancy	None	Qualitative (Internet discussion)	*n* = 42	Pregnant women	Alcohol	80% mentioned alcohol abstinence; 20% talked about the consequences of drinking on the unborn babies. However, the concept of abstinence tends to be misunderstood because for most of them, abstinence was not perceived as "not drinking at all" while little is known about the consequences of alcohol consumption for the unborn babies
Jones and Telenta	2012	Australia	Explore attitudes towards alcohol consumption during pregnancy	None	Qualitative (Semi-structured interview)	*n* = 12	Pregnant women	Alcohol	All the women believed there were no benefits to drinking alcohol while pregnant and that not drinking was the best option. Majority of them expressed a lack of knowledge of the actual risks of alcohol consumption on the foetus.
Leppo	2012	Finland	Investigate the perception of pregnant women about the risks involved in prenatal illicit drug use.	None	Qualitative (Semi-structured interview)	*n* = 14	Pregnant and postpartum women	Illicit drug - Buprenorphine	The women were not primarily concerned about the health risks of illicit drugs; their greatest fears were giving birth to a child with withdrawal symptoms; they did not see abstaining from drugs as a risk-free option.

Table 20 Studies which reported on health beliefs, attitudes and knowledge

Author	Year	Country	Objectives	Methods		Population characteristics		Medicine/Substance studied	Major findings
				Theoretical framework	Data collection	Sample size	Study participants		
Barbour	1990	USA	Explore the drinking behaviours of pregnant women and factors influencing the behaviours	None	Qualitative (Interview)	*n* = 20	Pregnant women	Alcohol	19 of the women knew about the dangers of alcohol in pregnancy; many of them believed that wine or beer is not as bad as other forms of alcohol and that alcohol can only cause problems in early pregnancy; they also believed that it is dangerous to the foetus only if large amounts are consumed.
Butters and Howie	1990	United Kingdom	Assess the attitudes and knowledge among pregnant women of the effects of commonly used drugs, cigarette and alcohol on the foetus	None	Quantitative (Self-administered questionnaire)	*n* = 514	Postpartum women	Precription and Over-the-counter medicines, Cigarette and Alcohol	85% of the women recognised that the foetus is most at risk of being harmed by drugs during the first 3 months of pregnancy; 83% felt it was safest not to smoke any cigarettes at all during pregnancy; 88% were aware of the adverse effects of smoking on foetal growth; 55% thought that alcohol should be avoided during pregnancy while 28% considered it safe to consume one drink a week. 51% thought that drinking alcohol in pregnancy could result in growth retardation and 66% thought it could cause foetal abnormalities. 49% said they would take an antibiotic prescribed by the doctor while 48% said they would not. 16% would avoid taking any form of analgesia during pregnancy.

Table 20 Studies which reported on health beliefs, attitudes and knowledge (continued)

Lelong et al	1995	France	Investigate the attitudes and behaviour of pregnant women towards tobacco and alcohol consumption	None	Quantitative (Interview with a structured questionnaire)	*n* = 176	Pregnant and postpartum women	Alcohol and Tobacco	Most women were aware that alcohol and tobacco could be harmful to their babies but heavy drinkers recognised the influence of alcohol in pregnancy less often than the others. Sixty percent (60%) of the women thought that two drinks per day was a reasonable level of consumption during pregnancy.
Milla et al	2007	Honduras	Determine the knowledge, attitudes, and practices related to folic acid and birth defects among postpartum women	None	Quantitative (Interview with questionnaire)	*n* = 2619	Postpartum women	Over-the-counter medicine - Folic acid	37.6% of the women were aware that folic acid helped to avoid birth defects and was good for the growth and development of the baby; 24.1% felt folic acid was a vitamin or was related to anaemia or iron; 7.8% thought folic acid was good for health in general.
Holst et al	2009	United Kingdom	Determine the motivations for the use of herbal medicine during pregnancy	None	Qualitative (Focus group discussion)	*n* = 6	Pregnant women	Herbal medicines	The women were aware of the fact that nothing is absolutely safe but they believed that herbs are safer than pharmaceuticals. They also knew that interactions of herbals with pharmaceuticals could occur.
Jones and Telenta	2012	Australia	Explore attitudes towards alcohol consumption during pregnancy	None	Qualitative (Semi-structured interview)	*n* = 12	Pregnant women	Alcohol	All the women believed there were no benefits to drinking alcohol while pregnant and that not drinking was the best option. Majority of them expressed a lack of knowledge of the actual risks of alcohol consumption on the foetus.

3.4.2 Themes identified

The themes identified in the reviewed articles are presented under 2 major headings – ‘Health beliefs and attitudes’ and ‘Knowledge’.

3.4.2.1 Prescription medicines

3.4.2.1.1 Health beliefs and attitudes

- ***Being restrictive or careful about use***. This theme was identified in 2 studies. In a Norwegian study by Nordeng et al. (2010a), 87.4% of the 866 participants believed that pregnant women should be more restrictive regarding use of medications during pregnancy. Forty-eight percent (48%) of 514 postpartum women from the UK article by Butters and Howie (1990) stated that they would not take an antibiotic prescribed by the doctor.

3.4.2.1.2 Knowledge

- ***Trimester of risk***. Only one study reported on the knowledge of women about prescription medicine use during pregnancy. Butters and Howie (1990) in a UK study of 514 postpartum women found that 85% of the participants recognised the first 3 months of pregnancy as the period when the foetus is most at risk of being harmed by medicines.

3.4.2.2 Over-the-counter medicines

3.4.2.2.1 Health beliefs and attitudes

- ***Being restrictive or careful about use***. This theme was also noted in 3 studies. Baric and MacArthur (1977) reported that 75% of 243 participants thought that a pregnant woman should not take any medicines without first consulting a doctor; 92.4% of a sample of 173 pregnant women agreed with the statement that medications should be avoided during pregnancy (Dow-Clarke et al., 1994) while in a UK study of 514 postpartum women, 16% stated that they would avoid taking any form of analgesia during pregnancy (Butters and Howie, 1990).
- ***Benefits of vitamins***. The attitudes of women about the benefits of vitamins were highlighted in 2 articles. Milla et al. (2007) indicated that 24.1% of the 2619 respondents felt folic acid was a vitamin or was related to anaemia or iron while 7.8% of the women thought folic acid was good for health in general. This finding is not far removed from the report by Bercaw et al. (2010) in which 22% of the 485 postpartum responders expressed beliefs that vitamins are safe to use.

3.4.2.2.2 Knowledge

- ***Benefits of vitamins***. The Honduran study by Milla et al. (2007) also found that 37.6% of the participants were aware that folic acid helped to avoid birth defects and was good for the growth and development of the baby.

3.4.2.3 Complementary and alternative medicines

3.4.2.3.1 Health beliefs and attitudes

- ***Efficacy***. Four studies described women's beliefs about the efficacy of complementary and alternative medicines with or without comparison to conventional medicines. The study by Fakeye et al. (2009) in Nigeria found that 81% of the 595 pregnant women believed in the efficacy of herbal medicines. In Australia, another study with 220 respondents revealed that 36.4% of them believed complementary and alternative medicines to be more effective than conventional medicines (Gaffney and Smith, 2004). In a sample of 485 postpartum women in the USA, Bercaw et al. (2010) discovered that 20% of the women believed that herbs are better at treating medical problems than prescription medication. Lapi et al. (2008) however indicated that 62.7% of the 172 participants considered complementary and alternative medicines as having equal efficacy as conventional drugs.
- ***Safety***. The beliefs and attitudes of pregnant women about the safety of complementary and alternative medicines were reported by 7 papers – 1 qualitative and 6 quantitative. Fakeye et al. (2009) demonstrated that 33.4% felt herbal medicines were safe. Gaffney and Smith (2004) reported that majority of the pregnant respondents considered the use of complementary and alternative medicines to be safe during pregnancy and 50% of them felt that complementary treatment is a more natural form of healing than conventional medicine. Bercaw et al. (2010) indicated that 22% of the participants believed that herbs are safer to use than prescription medication. In a

qualitative study- focus group discussion of 6 participants in the UK - Holst et al. (2009b) reported that the pregnant women believed that herbs are safer than pharmaceuticals. Lapi et al. (2008) indicated that 52% of the pregnant women were convinced that complementary and alternative medicines are safer than conventional medications. In a study of 400 postpartum women in Norway, Nordeng and Havnen (2005) reported that 62.3% of the women agreed that herbal drugs generally give less adverse effects than conventional drugs and 57% of them agreed that herbal drugs can be used by pregnant women. In addition, 40.8% of the respondents believed that pregnant women should preferably use herbal drugs than other drugs. Furthermore, in the article by Nordeng et al. (2010a), 22.9% of the 866 pregnant women agreed that natural remedies are safer than conventional medicines; about 12% of them agreed that herbal medicines can generally be used by pregnant women; and about 13% of the study participants agreed that pregnant women should preferably use herbal remedies during pregnancy.

- ***Seeking advice/consent from the doctor***. Three articles indicated the attitudes of women about seeking advice before using complementary and alternative medicines during pregnancy. Bercaw et al. (2010) reported that half of the study respondents agreed that they would use herbs if given information about it by a doctor. Nordeng and Havnen (2005) noted that 56.5% of the subjects agreed that pregnant women should not use herbal drugs without the consent of the physician. Nordeng et al. (2010a) also reported that 69.6% of

the study participants believed that pregnant women should not use herbal remedies without the consent of the doctor.

- ***Holistic approach and participation in maintaining health****.* Gaffney and Smith (2004) demonstrated that 61.4% of the subjects said they valued the emphasis on treating the whole person which is the usual approach of complementary practitioners; 52.3% believed that complementary and alternative medicines enable them to take a more active part in maintaining their health and 11.4% of them agreed that they have a more equal relationship with their complementary practitioner than with their doctor.

3.4.2.3.2 Knowledge

- ***Safety issues and drug interactions***. Holst et al. (2009b) demonstrated that the 6 pregnant women who participated in a focus group discussion were aware of the fact that nothing is absolutely safe in pregnancy. They also knew that interactions of herbals with pharmaceuticals could occur.

3.4.2.4 Illicit substance (Buprenorphine)

3.4.2.4.1 Health beliefs and attitudes

- ***Health risks to mother and baby****.* In a Finnish study by Leppo (2012), it was reported that the women were not primarily concerned about the health risks to themselves of illicit drugs but their greatest fears were giving birth to a child with withdrawal symptoms. They also did not see abstaining from drugs as a risk-free option.

3.4.2.5 Tobacco

3.4.2.5.1 Health beliefs and attitudes

- ***Health risks to mother and baby***. Four articles reported on women's beliefs about the health risks of tobacco use on themselves and the developing child. A South African study (Steyn et al., 1997) reported that in a sample of 394 pregnant women, 88.8% of them believed that smoking is bad for the mother's health while 92.1% believed that smoking is bad for the unborn baby's health. Similarly, the article by Torres et al. (2011) reported that 97% of the 192 pregnant participants believed women who smoke can harm their health, 98% believed pregnant women who smoke can harm their unborn baby's health, 33% believed tobacco use can cause general illness, 15% believed it can cause cancer and 1% believed it can lead to death. Garcias and Schuler-Faccini (2004) in their Brazilian work on 3219 postpartum respondents also reported that 88.4% of them believed that tobacco smoking can cause congenital defects. In the study by Chomba et al. (2010), 86.5% of the 1756 pregnant women thought cigarette smoking during pregnancy can harm the baby while 96.8% felt cigarette smoking can harm a woman's health.
- ***Reduction or no intake***. Two studies documented women's attitudes to smoking during pregnancy. Baric and MacArthur (1977), in a quantitative work on 243 participants reported that 39% of them thought that a pregnant woman was not expected to smoke at all while 40% thought that pregnant women were expected to reduce the number of cigarettes smoked. Similarly, Butters and Howie (1990) in

their UK quantitative work on 514 postpartum participants showed that 83% of them felt it was safest not to smoke any cigarettes at all during pregnancy.

- ***Benefits of smoking***. In an in-depth interview of 20 pregnant adolescents conducted in the USA by Lawson (1994), the respondents believed that cigarette smoking controlled body weight and that cessation consistently produced marked weight gain. They also believed that cigarette smoking would assure having a smaller baby which would result in a shorter labour and less painful delivery.

3.4.2.5.2 Knowledge

- ***Awareness of health risks to the baby***. Six articles demonstrated the awareness of the women about the risks of smoking during pregnancy on the foetus. In a quantitative research conducted on 176 pregnant and postpartum women in France (Lelong et al., 1995), most of the women were aware that tobacco could be harmful to the baby. A similar Turkish study by Karcaaltincaba et al. (2009) also reported that 97.5% of the 1020 participants knew smoking was harmful while 62.5% were aware of at least three hazardous effects. The study of 864 pregnant women in Lebanon (Chaaya et al., 2004) reported that 78.4% of the respondents knew that cigarette affects the foetus, 76.8% knew that cigarette affects the newborn, 68.7% were aware that cigarette contains addictive substances while 69% knew it contains carcinogens. An Irish study conducted by Daly et al. (1992) demonstrated that 93 of the 100 postpartum women were aware of the harmful effects of smoking during pregnancy. In a UK study by

Butters and Howie (1990), 88% of the participants were aware of the adverse effects of smoking on foetal growth. In terms of the specific health hazards associated with smoking, Griffiths et al. (2005) carried out a study in the UK with 145 pregnant women. The authors reported that 92% of the participants were aware that smoking can cause lung cancer, 76% knew it can cause myocardial infarction, 50% knew it can cause miscarriage, 34% were aware it can cause ante-partum haemorrhage, 44% knew it can cause decreased birth weight, 33% knew it can cause slower cognitive development while 38% of the women were aware it can lead to cot death.

- ***Insufficient information about health risks to the baby***. In 2 articles, the authors reported that women had insufficient or no information about the risks of tobacco use on the developing baby. The article by Kralikova et al. (2005) which was a research carried out in Czech Republic reported that most of the 265 postpartum women had insufficient information about the impact of smoking on the baby. Similarly, a quantitative research of 310 pregnant women in Papua New Guinea (Senn et al., 2009) demonstrated that 80% of the women perceived no risk to the foetus in using betel nut ('smokeless' tobacco) during pregnancy.

3.4.2.6 Alcohol

3.4.2.6.1 Health beliefs and attitudes

- ***Health risks to the baby***. Three articles highlighted expectant mothers' beliefs about the risks of alcohol consumption on the foetus. Butters and Howie (1990) showed that 51% of the participants thought

that drinking alcohol in pregnancy could result in growth retardation and 66% thought it could cause foetal abnormalities. In a Brazilian study by Garcias and Schuler-Faccini (2004) in which 3219 postpartum women were interviewed with a questionnaire, 88.8% of them believed that alcohol consumption can cause congenital abnormalities. It was also reported by Raymond et al. (2009) in a qualitative study of 20 pregnant women conducted in the UK that most of the participants considered that there were risks involved with drinking during pregnancy.

- ***Quantity and period associated with risks***. This was reported in 2 papers. In a sample of 20 pregnant women recruited for a qualitative study in the USA by Barbour (1990), many of the women believed that alcohol can only cause problems in early pregnancy. They also believed that alcohol is dangerous to the foetus only if large amounts are consumed. Kesmodel and Kesmodel (2002) indicated that 85% of the subjects believed that binge drinking was potentially harmful to the foetus.
- ***Comparative safety of alcohol types***. Women's comparison of the safety of alcohol types were documented in 2 studies. In a qualitative interview with 321 pregnant women in the USA by Kaskutas (2000), it was reported that 26% of beer drinkers said beer is safer, 31% of wine drinkers felt wine is safer and 26% of wine cooler drinkers said wine cooler is safer than other kinds of alcohol. Barbour (1990) also found that many of the women believed that wine or beer is not as bad as other forms of alcohol.

- ***Reduction or no intake***. Seven papers demonstrated the attitudes of pregnant women to alcohol consumption during pregnancy. Senecky et al. (2011), in an Israeli study of 3815 postpartum women showed that 71.6% of the respondents felt that women should not consume alcohol at all during pregnancy while 21.4% thought it was permissible if limited to 2 drinks per week. In a French study by Lelong et al. (1995), 60% of the participants (*n* = 176) thought that 2 drinks per day was a reasonable level of consumption during pregnancy. A Canadian study by Dow-Clarke et al. (1994) recruited 173 pregnant women and discovered that 43.4% of the respondents agreed with the statement that it is okay to drink occasionally during pregnancy. Butters and Howie (1990) reported that 55% of the 514 participants thought that alcohol should be avoided during pregnancy while 28% considered it safe to consume one drink a week. Baric and MacArthur (1977) reported that 51% of the 243 participants in their UK study felt that pregnant women are expected to reduce their drinking or to drink only small amounts of alcohol while 8% felt they were expected to stop taking alcohol completely. A Danish work by Kesmodel and Kesmodel (2002) on 439 pregnant women revealed that 76% of them considered some alcohol intake during pregnancy to be acceptable on a weekly basis. All the women (*n* = 12) in a qualitative interview by Jones and Telenta (2012) in Australia believed there were no benefits to drinking alcohol while pregnant and that not drinking was the best option.

- ***Beneficial effects of drinking***. Baric and MacArthur (1977) reported that 7% of the participants believed that there was a beneficial effect in drinking stout during pregnancy.

3.4.2.6.2 Knowledge

- ***Awareness of health risks to the baby.*** Six articles described the knowledge of women about the risks of taking alcohol during pregnancy on the baby. In a French study by Lelong et al. (1995), most of the 176 participants were aware that alcohol can be harmful to the baby but heavy drinkers recognised the influence of alcohol in pregnancy less often than the others. A large questionnaire study of 14,239 pregnant women was carried out in Japan by Yamamoto et al. (2008). This study reported that 72.8% of the women had knowledge regarding the risks of alcohol consumption during pregnancy. Chang et al. (2006) reported that 79.9% of the subjects were aware that there is no universally safe level of prenatal alcohol use while 94% knew that alcohol exposure may have negative effects throughout pregnancy. In the USA, Barbour (1990) employed a qualitative approach to interview 20 pregnant and discovered that 19 of them knew about the dangers of alcohol in pregnancy. Daly et al. (1992) in their Irish study documented that 58 of the 100 postpartum respondents were aware of the harmful effects of alcohol during pregnancy. In a Ghanaian study by Adusi-Poku et al. (2012), 78% of the 397 sample of pregnant women said alcohol could be harmful.
- ***Insufficient information about health risks to the baby.*** This theme was identified in 3 papers. In France, Toutain (2010) carried out a

qualitative research in form of internet discussion with 42 pregnant women and discovered that the concept of abstinence tends to be misunderstood by the women. For most of them, abstinence was not perceived as “not drinking at all”. Also, little is known about the consequences of alcohol consumption for the unborn babies. Majority of the pregnant women in an article by Jones and Telenta (2012) expressed lack of knowledge of the actual risks of alcohol consumption on the foetus. Similarly, a Korean work by Kim and Park (2011) on 221 postpartum women investigated the knowledge of participants about alcohol risks. It was discovered that the knowledge level regarding alcohol risks and foetal alcohol syndrome among participants was poor.

3.5 Discussion

3.5.1 Methodological issues

In designing appropriate intervention strategies as well as effective implementation which is targeted at promoting healthy behaviours in pregnancy, the importance of recognising and understanding the common beliefs, attitudes and knowledge of women about medicine and recreational substance use cannot be over-emphasised.

The articles included in this review represent different quantitative and qualitative approaches for investigating the health beliefs, attitudes and knowledge of expectant mothers regarding medicines and recreational substance use in pregnancy. It is noteworthy that the papers are from

different parts of the world; health care beliefs and practices are diverse, complex and differ across ethnic, cultural and social boundaries. Culture has some influence on perceptions of health and diseases while antenatal services and policies also differ between countries. Furthermore, there is heterogeneity amongst articles due to differences in study objectives, sample sizes, data collection methods (quantitative or qualitative), study participants (pregnant or postpartum women) and the medicines or recreational substances studied. A major cause of heterogeneity is the data collection methods employed by the papers. Therefore, the findings should be interpreted with caution.

In the quantitative studies, participants were either interviewed with a questionnaire or self-administered the questionnaires. Only one of the reviewed articles employed self-administered internet questionnaire. Self-administered questionnaires are thought to be less prone to influences on response patterns (Cartwright, 1988). However, the study objectives, the introductory letter and the questionnaire lay-out all have some influence on the response (Lyberg and Kasprzyk, 1991). On the other hand, interviewing participants with a questionnaire allow each participant to ask clarifying questions, thus enhancing more complete answers (Nordeng and Havnen 2005). The internet questionnaire is an efficient way of collecting population-based data as it helps to reduce the risk for sampling bias but its limitation is that not all households have access to the internet and it is likely that those who will participate in the study will have a higher education than the general population of pregnant women (Nordeng et al., 2010a).

Generally, quantitative studies are based on responses to questions which participants might not be able to expand on. Also, the data collection instruments – questionnaires - used by the different studies might vary; there could have been inconsistencies in the questions asked and how they were framed. Furthermore, it is not possible to assess all aspects of beliefs, attitudes and knowledge with the use of questionnaire as some other aspects cannot be covered due to the choice of statements in the questionnaire (Nordeng et al., 2010a).

The different approaches to the qualitative method of data collection employed by the articles were focus group discussion, face-to-face individual interview, telephone interview and internet discussion. Focus groups can stimulate discussion through group dynamics; the interaction within the group provides a social context in which participants can develop their ideas (Krueger, 1994; Pletsch and Johnson, 1996). However people may also feel uncomfortable about disclosing or expressing their views on sensitive issues with complete strangers (Krueger, 1994; Van der Kooi and Theobald, 2006). Face-to-face individual interviews have the advantage of eliciting non-verbal information (Raymond et al., 2009); its disadvantage is that it is expensive and has the potential of producing interviewer effects in terms of producing responses that depend partly on how the interviewer looks, poses the questions, and expresses his or her body language (Bradburn and Sudman, 1979). Telephone interviews are usually less expensive than face-to-face interviews (Frey, 1989); and interviewer effects are expected to be lower than in face-to-face interviews (Nybo Andersen and Olsen, 2002). It has been reported that women are more open in an anonymous telephone

interview compared to face-to-face interview at an unfamiliar location (Raymond et al., 2009). However, the absence of face-to-face contact with the interviewer might have some influence on participant's responses (Kormendi and Noordhoek, 1989). An internet discussion was carried out in one study. As stated earlier under the internet questionnaire, the limitation of this data collection method is that the participants are more likely to be more educated than the general pregnant population (Nordeng et al., 2010a). Additionally, none of the qualitative articles employed a theoretical framework in the studies.

3.5.2 Major Findings

Some of the articles in this review studied more than one medicine or recreational substance; 31 of the reports were on alcohol and tobacco, few articles studied prescription, over-the-counter and complementary and alternative medicines while only one article reported the beliefs and attitudes of pregnant women about an illicit substance.

The 2 studies on prescription medicines revealed that women's health beliefs and attitudes were more of being restrictive or careful about medicine use during pregnancy. The first trimester was also noted by women to be the period when the foetus is most at risk of being harmed by medicines.

The articles on over-the-counter medicines also showed that women's health beliefs and attitudes were more of being careful or restrictive about use of such medicines during pregnancy. The studies also found that women knew and believed that vitamins were good for the growth and development of the baby, helped to avoid birth defects, and were safe to use.

Most of the articles on complementary and alternative medicines demonstrated that women believed in the safety and efficacy of the therapies. They however felt it is better to seek the consent or advice of the doctor before using the therapies. One article further indicated that women were aware that interactions of herbals with conventional medicines could occur while another study reported women's positive attitude about the holistic approach and active participation in maintaining health which complementary and alternative medicines offer them.

With regard to alcohol, most of the studies demonstrated that women believed that abstinence or reduction in intake during pregnancy were the safe options. The participants were also aware and believed in the health risks of alcohol consumption during pregnancy on the unborn baby. A few other articles reported that: women believed that consumption of alcohol in early pregnancy and binge drinking can be potentially harmful to the foetus; wine or beer were safer than other types of alcohol; there are beneficial effects of drinking in pregnancy; and that women had insufficient information about the health risks of consumption on the unborn child.

Most of the studies on tobacco similarly showed that women were aware and believed in the health risks of consumption during pregnancy on the foetus and the mother. Two of the articles also reported that women believed that abstinence or reduction in intake during pregnancy were the safe options. In contrast to these findings, a study on pregnant adolescents discovered their beliefs on the benefits of smoking in pregnancy with regard to body weight control, having a smaller baby, shorter duration of labour, and less painful

delivery. Two other papers reported women's insufficient knowledge about the risks of tobacco use during pregnancy on the developing baby.

The only study on illicit substance reported that the women were not primarily concerned about the health risks to themselves of illicit substances but their greatest fears were giving birth to a child with withdrawal symptoms; they also did not see abstaining from drugs as a risk-free option.

3.6 Implications for this thesis

This review has provided information on the common health beliefs, attitudes and knowledge of women about medicine and recreational substance use during pregnancy. However, some gaps have been identified in the international literatures.

First, most of the published studies are quantitative (section 3.4.1), and little is known about women's in-depth beliefs, attitudes and knowledge about medicine and recreational substance use and the impact of these factors on health behaviours in pregnancy. Thus, qualitative approach is necessary in future studies since this possess a great value in sensitively exploring perceptions, experiences and understanding of issues in different contexts (Van der Kooi and Theobald, 2006).

Second, in the identified articles which employed qualitative data collection methods, there is lack of theoretical research processes in the studies as none of them employed a theoretical framework. Therefore, another aspect which needs to be developed is the use of a theoretical framework which takes into account the context of the lives of the expectant mothers. Such a theoretical framework enables researchers to look at issues or problems

from different angles while focusing their attention on the different parts of the data. It also provides a framework for data analysis and may contribute to the designing of intervention strategies in order to improve maternal and foetal outcomes (Reeves et al., 2008). Accordingly, future qualitative studies which will employ theoretical frameworks are important to enrich the understanding of these factors in pregnancy and how women contextualise issues.

Third, only 6 papers studied all the factors of interest – health beliefs, attitudes and knowledge (Table 20) out of which 3 were published in the last decade. Therefore, current studies which aim to link health beliefs and attitudes to knowledge are necessary in order to determine the impact of knowledge on the other factors and to define and explain relationships. For example, Leppo (2012) investigated the perceptions of pregnant women about the risks involved in prenatal illicit substance use. The author found as part of the results that 'the women did not see abstaining from drugs as a risk-free option'. An assessment of the women's knowledge on the subject matter would have provided the researcher with additional information on why the participants held such a belief.

Fourth, majority of the studies (n = 32) were carried out both on subjects that used and did not use medicines or recreational substances while only 3 studies were conducted only on those that used medicines and recreational substances (Lawson, 1994; Holst et al., 2009b; Leppo, 2012). It is therefore possible that in those 32 studies, users and non-users will have different beliefs or attitudes depending on their level of knowledge. Future qualitative studies which would aim for women who have used medicines or

recreational substances are especially important to determine their perceptions about what they have used. Results from such studies can help to better clarify relationships between factors while also informing the provision of evidence-based counselling about use of medicines and recreational substances in the antenatal period.

Fifth, it is important to note that fewer number of articles reported on prescription medicines (n = 2), over-the-counter medicines (n = 5) and complementary and alternative medicines (n = 7) compared to recreational substances (n = 32). However, studies have reported that some pregnant women have medical conditions which require pharmacological treatment and that avoidance of medicine use can be impractical in such situations (Andrade et al., 2004; Bakker et al., 2006). Since people's health beliefs, attitudes and knowledge have significant impacts on health behaviours, findings from future qualitative work on medicine use in pregnancy can provide a greater insight into the types of health behaviour changes which occur as a result of pregnancy and the reasons for such changes.

Finally, in the last two decades, only 3 United Kingdom studies were identified in this review. Griffiths et al. (2005) was a quantitative study of women's knowledge of the risk of tobacco in pregnancy; Holst et al. (2009b) reported a focus group discussion of six women about their beliefs and knowledge of herbals in pregnancy; while Raymond et al. (2009) qualitatively explored women's attitudes towards alcohol consumption during pregnancy (Table 21). These imply that further work on this topic is especially necessary.

Table 21 Studies carried out within the United Kingdom in the past two decades

Author	Year	Country	Objectives	Methods		Population characteristics		Medicine/Substance studied	Major findings
				Theoretical framework	Data collection	Sample size	Study participants		
Griffiths et al	2005	United Kingdom	Assess pregnant women's knowledge of foetal and maternal risk of smoking and to determine the motivators for smoking cessation	None	Quantitative (Interview with a questionnaire)	*n* = 145	Pregnant women	Tobacco	92% of the women were aware that smoking can cause lung cancer; 76% knew it can cause myocardial infarction; 50% knew it can cause miscarriage; 34% were aware it can cause ante-partum haemorrhage; 44% knew it can cause decreased birth weight; 33% knew it can cause slower cognitive development; 38% were aware it can lead to cot death.
Holst et al	2009	United Kingdom	Determine the motivations for the use of herbal medicine during pregnancy	None	Qualitative (Focus group discussion)	*n* = 6	Pregnant women	Herbal medicines	The women were aware of the fact that nothing is absolutely safe but they believed that herbs are safer than pharmaceuticals. They also knew that interactions of herbals with pharmaceuticals could occur.
Raymond et al	2009	United Kingdom	Explore pregnant women's attitudes towards drinking alcohol in pregnancy and their attitudes towards sources of information about drinking in pregnancy	None	Qualitative (Telephone interview)	*n* = 20	Pregnant women	Alcohol	Most women considered that there were risks involved with drinking during pregnancy.

3.7 Summary

This narrative review provides researchers and healthcare professionals with the common health beliefs, attitudes and knowledge about medicine and recreational substance use in the pregnant population. However, the published articles on this topic are mainly quantitative studies, hence there is scarcity of information on women's in-depth beliefs, attitudes and knowledge about medicine and recreational substance use during pregnancy and the effects of these on health behaviours.

The review therefore underscores the fact that a comprehensive understanding of these factors and their relationships is necessary and can better be provided by employing qualitative approach (which incorporates a theoretical framework) in data collection. Findings from such qualitative studies would also help to complement and broaden the results of the existing quantitative studies. This additional knowledge would be invaluable to women's health researchers and those involved in maternity care services. Thus chapter 4 of this thesis investigates the health beliefs of pregnant women using a qualitative data collection method.

CHAPTER 4 - A QUALITATIVE STUDY ON THE HEALTH BELIEFS OF PREGNANT WOMEN

4.1 Introduction

The health-related activities that pregnant women engage in and the extent to which they follow treatment regimens are related to their beliefs or perceptions (Heaman et al., 2004).

Since the thalidomide tragedy, standard medical advice has been that no medicines are safe to use during pregnancy (Baggley, 2004). Healthcare professionals still advise pregnant women to avoid medicines unless if it is extremely necessary. Because most pregnant women will do everything possible to have a normal and healthy baby, they are most likely to heed this advice. (Baggley, 2004).

The claims that complementary therapies are natural and safe may appeal to pregnant women who are often concerned about their unborn baby's wellbeing (Nordeng and Havnen 2005). It has been proposed that users of these modalities hold a particular set of values and beliefs which may have contributed to their reasons for choosing them (Easthope, 1993).

As regards recreational substances, contact with the health care system increases the likelihood that pregnant women will change their habits to protect the developing child (Chaaya et al., 2004). However, it has been pointed out that expectant mothers' behaviour will in any case be made according to risk perception and available information from health personnel, media, friends and family which are evaluated against previous experience (Kesmodel and Kesmodel 2002).

Understanding health beliefs has emerged as an important concept in developing behavioural change programmes since the 1980s, although few

studies have been undertaken to explore these issues in the pregnant population. (Nutbeam and Harris, 2004).

Thus, it is crucial to determine the health beliefs of expectant mothers about medicine and recreational substance use during pregnancy as the findings can provide a basis for development of relevant clinical interventions in order to promote maternal and foetal health.

4.2 Aim

To investigate the beliefs of pregnant women about their health as well as medicine and recreational substance use in pregnancy.

4.3 Research questions

1. What are the perceptions of pregnant women about their health in pregnancy?
2. What are the perceptions of pregnant women about their unborn baby's health?
3. How do maternal characteristics influence perceptions of health of the mother and unborn baby?
4. How do pregnant women's perceptions influence medicine or recreational substance use during pregnancy?

4.4 Research Ethics

An amendment of the protocol for the quantitative study was made to include the qualitative interviews as part of the follow up of the women in the third trimester. This was submitted to the South East London REC 3 (Research Ethics Committee 3). Approval was obtained and the qualitative study was carried out only with participants from University College London Hospital.

The R and D (Research and Development) approval was obtained from the hospital before participants were interviewed.

4.5 Methods

4.5.1 Phenomenological approach

A phenomenological approach was employed in this study. This approach describes the meaning for individuals of their lived experiences of a concept or a phenomenon. As such the study is powerful for understanding subjective experience, the features of the phenomenon as well as gaining insights into people's motivations and actions. It would be important to understand these experiences of individuals in order to develop practices and policies or to inform, support or challenge policy and action (Lester, 1999; Creswell, 2007). Knowing some common experiences can be valuable for groups such as therapists, teachers, health personnel, and policymakers. Hence, phenomenology is popular in the social and health sciences, nursing, psychology and education (Creswell, 2007).

To this end, qualitative researchers identify a phenomenon of interest to study - an "object" of human experience (van Manen, 1990). This human experience may be phenomena such as insomnia, anger, grief, professionalism, what it means to be underweight, or what it means to be a wrestler. Data are then collected from the individuals who have experienced the phenomenon. Often data collection in phenomenological studies consists of in-depth interviews and multiple interviews with participants. A variety of other methods can also be used, including conversations, participant

observation, action research, focus meetings, discussions and analysis of personal texts and representing it from the perspective of the research participants (Creswell, 2007).

Polkinghorne (1989) recommends that researchers interview from 5 to 25 carefully chosen individuals who have all experienced the phenomenon in question, so that the researcher, in the end, can forge a common understanding. After data collection, the researcher develops a composite description of the essence of the experience for all of the individuals. This description consists of “what” they experienced and “how” they experienced it (Moustakas, 1994). Phenomenology is not only a description, but it is also seen as an interpretive process in which the researcher makes an interpretation (i.e., the researcher “mediates” between different meanings) of the meaning of the lived experiences (van Manen, 1990).

This is in contrast to the grounded theory approach which moves beyond description and interpretation to generate or discover a theory, an abstract analytical schema of a process, action or interaction (Strauss and Corbin, 1998).

4.5.2 Justification for choosing the Health Belief Model as the theoretical framework

In section 3.6 of chapter 3, it was suggested that qualitative research which incorporates a theoretical framework is the most suitable method of collecting data about the perceptions, beliefs and attitudes of expectant mothers.

Qualitative research focuses on how people interpret their experiences and how they use those interpretations to guide their way of life. It is “the most

appropriate method of gathering data when the purpose of the research is to expose beliefs, perceptions, attitudes, and opinions that are otherwise hidden in people's minds" (Ritchie, 2001). Thus, interviews make it possible for respondents to use their own words to describe their views and beliefs and this helps achieve a better and broader understanding of such beliefs and views. It is generally believed that interviews can capture perceptions in ways that a questionnaire cannot (Rich and Ginsburg, 1999).

Furthermore the use of theories in qualitative research is important in patient care and health policy because it enables researchers to gain insights into the processes which occur latently, develop the knowledge of the underlying principles to such processes, and to translate and present such to the stakeholders. The use of theories in qualitative research is therefore immediate, insightful, and applicable in practice (Reeves et al., 2008). There are many theories and models which can be used to assess health beliefs, but the most commonly used are summarised below.

- **Theory of Planned Behaviour (TPB)** is a behavioural prediction theory which represents a social-psychological approach to understanding and predicting the determinants of health-behaviour (Montano et al., 1997). It suggests that performance of a given behaviour is a function of both the intentions and perceived behavioural control (Jones et al., 2009). There are several limitations of the TPB, which include that it does not account for other variables that affect behavioural intention and motivation, such as fear, threat, mood, or past experience. It also does not take into account environmental or economic factors that may influence a person's

intention to perform a behaviour. Furthermore, the majority of TPB research has focused on the prediction of behavioural intention rather than on the behaviour itself. Unfortunately, because the correlation between behaviour and intention is not particularly impressive, research on attitudes and behaviours is often dismissed (Redding et al., 2000).

- **The Transtheoretical Model (TTM)** or Stages of change model is a model of intentional behaviour change (Redding et al., 2000). The model has informed the development of numerous interventions to facilitate health-related behaviour change in the past two decades and is considered by many to be the dominant model of health behaviour change (Armitage, 2009). The model describes five stages of a person's readiness to change an unhealthy behaviour – Pre-contemplation, Contemplation, Preparation, Action and Maintenance. (Jones et al., 2009). One of the limitations of the model is that it assumes that individuals make coherent and logical plans in their decision-making process when this is not always true. The theory also ignores the socio-economic context in which change occurs.
- **Social Cognitive Theory (SCT)** emphasizes what people think and its effect on their behaviour (Perry et al., 1990; Baranowski et al., 1997). The theory goes well beyond individual factors in health behaviour change to include environmental and social factors. In fact, this theory may be the most comprehensive model of human behaviour yet proposed. The concept of SCT states that there is a continuous, dynamic interaction between the individual, the

environment, and behaviour. Thus, a change in one of these factors impacts on the other two (Redding et al., 2000). As the theory involves numerous key concepts and can be broad-reaching, its major shortcoming is that it can be difficult to operationalise in entirety.

- **The Health Belief Model (HBM)** is derived from behavioural and psychological theory. It was developed in the 1950s by social psychologists at the United States Public Health Services to help identify, explain and predict public attitudes and behaviour around health issues (Rosenstock, 1974; Janz and Becker, 1984). The model describes a person's health behaviour as an expression of health beliefs and is the most commonly used theory in health education and health promotion (Glanz et al., 2002; National Cancer Institute, 2003). It also provides a way to understanding and predicting how people will behave in relation to their health and how they will comply with treatment regimens. Since its development, the HBM has been employed in a variety of public health settings over the years. The model's ability to explain and predict variety of health-related behaviours has been validated across various domains and among wide range populations (Janz and Becker 1984; Carpenter, 2010), of which three broad areas can be identified: 1. Preventive health behaviours, which include health-promoting (e.g. diet, exercise) and health-risk (e.g. smoking) behaviours as well as vaccination and contraceptive practices; 2. Sick role behaviours, which refer to compliance with treatment regimens; and 3. Clinic use, which includes physician visits for a variety of reasons (Conner and Norman, 1996).

The model has also been used in designing many successful health interventions (Arik and Boeijen, 2009; Kharrazi, 2009).

The HBM was therefore chosen as the theoretical framework for this study because it is the most appropriate for the research aim and objectives. The main constructs of the model are Perceived Susceptibility, Perceived Severity, Perceived Benefits and Perceived Barriers (Rosenstock, 1974). Each of these perceptions, individually or in combination, can be used to explain health behaviour. More recently, other constructs have been added to the HBM; thus the model has been expanded to include Modifying Factors, Cues to Action and Self-Efficacy.

Perceived Susceptibility/Risk/Vulnerability. Personal risk or susceptibility is a powerful perception which helps in prompting people to adopt healthier behaviours. The greater the perceived risk, the greater the likelihood of engaging in behaviours to decrease risk (Rosenstock, 1974).

Perceived Severity/Seriousness. The construct of perceived severity is an individual's belief about the seriousness or severity of a disease or condition. While the perception of severity is often based on medical information or knowledge, it may also come from beliefs a person has about the difficulties a disease would create or the effects it would have on his or her life in general (Rosenstock, 1974). When the perception of susceptibility is combined with severity, it results in perceived threat (Stretcher and Rosenstock, 1997).

Perceived Benefits. This is a person's opinion of the value or usefulness of a new behaviour in decreasing the risk of developing a disease. People tend

to adopt healthier behaviours when they believe the new behaviour will decrease their chances of developing a disease (Rosenstock, 1974).

Perceived Barriers. This construct of the HBM addresses the issue of perceived barriers to change. It is an individual's own evaluation of the obstacles in the way of him or her adopting a new behaviour. Of all the constructs, perceived barriers are the most significant in determining behaviour change (Janz and Becker, 1984). In order for a new behaviour to be adopted, a person needs to believe the benefits of the new behaviour outweigh the consequences of continuing the old behaviour (Centres for Disease Control and Prevention, 2004). This enables barriers to be overcome and the new behaviour to be adopted.

Modifying Factors/Variables. The four major constructs of perception are modified by other variables, such as age, culture or ethnicity, educational status, occupation, past experiences and motivation. These are individual characteristics that influence personal perceptions (Rosenstock, 1974).

Cues to Action. In addition to the four beliefs or perceptions and modifying factors, the HBM suggests that behaviour is also influenced by cues to action. Cues to action are events, people or things that move people to change their behaviour. Examples include illness of a family member, media reports (Graham, 2002), mass media campaigns, advice from others, reminder postcards from healthcare provider, or health warning labels on a product (Ali, 2002).

Self-Efficacy. In 1988, self-efficacy was added to the HBM (Rosenstock et al., 1988). It is the belief in one's own ability to do something. People

generally do not try to do something new unless they think they can do it. If someone believes a new behaviour is useful (perceived benefit), but does not think he or she is capable of doing it, chances are that it will not be tried (Bandura, 1977).

It is worth pointing out some strengths and limitations of the HBM. The main strength of the model is its use of simplified health-related constructs that make it easy to implement, apply, and test (Conner, 2010). The HBM has provided a useful theoretical framework for assessing the cognitive determinants of a wide range of behaviours for over three decades. It has focused researchers' and healthcare professionals' attention on variables that are prerequisites for health behaviour. Thus, it provides a useful checklist of issues that need to be addressed and has formed a basis for many practical interventions across a range of behaviours (Jones et al., 1987). However, a limitation of the HBM is that it does not take into account social or environmental factors which can influence health behaviour. The model also did not expressly spell out the relationships between the variables and there are no clear rules for combining the formulated variables (Sheeran and Abraham, 1996; Armitage and Conner, 2000). However, this limitation can also be viewed as strength, because lack of strict rules of combination offers flexibility that makes the HBM adaptable and applicable to many health behaviour and population groups (Orji et al., 2012).

4.5.3 Data Collection

Semi-structured telephone interviews were carried out using an interview guide (Appendix 8). The development of the interview guide was informed by knowledge acquired from the literature review from this PhD project (Rosenstock, 1974; Janz and Becker, 1984; Rosenstock et al., 1988; Tiedje et al., 1992). The researcher received formal training courses on 'Qualitative Research, Interviews and Analysis' as well as coaching from Professor Felicity Smith of the Department of Practice and Policy who is an expert in qualitative research. The format of the interview guide was carefully planned such that the first set of questions was non-threatening and easy to answer.

A semi-structured approach was chosen because it ensured that participants remained focused on the topic while also enabling them to expand on their views. Furthermore, the interviews were conducted on telephone because it was more feasible than in the hospital setting where there could be distractions and lack of privacy. Moreover, telephone method was more convenient and created lesser burden on participants, allowing them to express themselves openly in their usual and familiar environment.

A pilot study was carried out with 3 postpartum women and the interview guide was revised based on their responses and with further inputs from Professor Smith. The pilot data was not included in the final analysis.

4.5.4 Sample size and recruitment

The purposive sampling technique, also called judgment sampling, is the deliberate choice of participants due to the qualities they possess. It is a non-

random or non-probability technique that does not need underlying theories or a set number of participants. Simply put, the researcher decides what needs to be known and sets out to find people who can and are willing to provide the information by virtue of knowledge or experience (Bernard 2002; Lewis and Sheppard 2006). In contrast, random or probability sampling is recommended whenever possible as a means of participant selection because randomisation reduces biases and allows for the extension of results to the entire sampling population. Results may also be applied beyond the community studied (Tongco, 2007). However, random sampling is not always feasible, and not always efficient. A high dispersion of samples may induce higher costs for a researcher (Alexiades, 1996; Bernard, 2002).

Purposive sampling is not free from bias. However when used appropriately, is more efficient than random sampling in practical field circumstances (Bernard, 2002) because the random participants may not be as knowledgeable and observant as an informed participant. This method is especially useful when there are not enough funds and other resources. Purposive sampling can be more realistic than randomisation in terms of efficiency, time, effort and cost needed in finding participants (Topp et al. 2004; Tongco, 2007). The inherent bias of the method contributes to its efficiency, and the method stays reliable and robust even when tested against random probability sampling (Bernard, 2002; Lewis and Sheppard, 2006). Hence, data collected from purposive sampling may still be valid for certain studies. There is no cap on how many participants should make up a purposive sample, as long as the needed information is obtained (Bernard, 2002). Seidler (1974) studied different sample sizes of participants selected

purposively and found that at least five participants were needed for the data to be reliable.

In this qualitative study, a purposive sampling technique was employed in order to get the information-rich cases (Malterud, 2001). A purposive sample of consecutive women in the third trimester who have used at least 2 types of medicines (prescription, over-the-counter, complementary and alternative medicines) with or without recreational substances during pregnancy and verbally consented to be interviewed was chosen. Twenty-two potential participants were approached for the interview but 2 of them declined due to other commitments and therefore 20 participants were recruited because it was more feasible within the available time frame of the project.

After explaining the purpose of the study and assuring confidentiality and anonymity, permission was obtained from each participant to record the interview.

The researcher (Mariam Wahab), who had been trained in interview techniques, had met all the women at the antenatal clinic during their first trimester scan while conducting the first part of her research. Her contact with them at the time of the interview was the third time hence she had already created a friendly and informal atmosphere prior to the interview which allowed the participants to speak and express their thoughts freely.

After each interview, the researcher listened to the audio recording and made her interview summaries before carrying out another interview. All the interviews were carried out by the researcher and each lasted between 24 and 35 minutes. The interviews were carried out from October 2012 to

January 2013 and the interviewees were not rewarded for their participation in the study. The demographic characteristics of the subjects had been collected during the first part of the project (the quantitative study).

All the interviews were audio-recorded and verbatim transcription was done by a paid transcriber. The transcripts were checked against the audio records by the researcher before coding and analysis.

4.5.5 Data analysis

Two interviews were coded independently by 2 researchers (Mariam Wahab and Dr. Chi Huynh who recently completed his PhD at the Centre for Paediatric Pharmacy Research and who also carried out a qualitative study as part of his PhD research). The initial coding frameworks by the researchers were compared and the discrepancies resolved in order to arrive at a single expanded one which was used to code the other interviews by Mariam Wahab (Appendix 9). Coding was carried out with the computerised qualitative data analysis package Nvivo 10 but the framework analysis was carried out manually (outside the Nvivo software).

The coding framework was used to develop the themes which were then used in answering the research questions. During this stage of the framework analysis, credibility of the results was ensured by having the 2 researchers (Mariam Wahab and Dr. Chi Huynh) carry out the analysis. The development of 3 themes, the interpretations made of the themes and the associations between the themes were carried out and a consensus was reached after discussions by the 2 researchers.

4.6 Results

4.6.1 Participants' characteristics

The mean age of the pregnant women was 32.7 years (the age range was between 26 and 41 years) and half of them were primigravida. Majority of the participants were whites (n = 14) and university-educated (n = 17). They were between 28 and 39 weeks pregnant at the time of interview (mean gestational age: 36.3 weeks). In the context of the Health Belief Model, the participant's characteristics are regarded as part of the modifying factors. These are shown in Table 22.

Table 22 Participants' characteristics

Participant ID	Age (years)	Ethnic origin	Education	Gravidity	Gestational age (weeks)
P1	30	White	University	2	28
P2	30	African	University	2	35
P3	37	White	University	3	35
P4	33	White	University	3	37
P5	34	White	University	1	39
P6	34	White	University	1	36
P7	35	White	University	2	37
P8	29	Black other	Vocational	2	35
P9	34	White	University	1	38
P10	35	Mixed	University	1	38
P11	30	African	University	1	39
P12	33	African	University	1	37
P13	34	White	University	2	35
P14	29	White	University	1	35
P15	41	White	University	1	36
P16	26	White	Secondary	3	36
P17	37	White	University	3	36
P18	34	White	University	1	38
P19	30	White	Secondary	5	37
P20	29	African	University	1	39

4.6.2 Medicines and recreational substances used during pregnancy

All the women used over-the-counter medicines the most common of which was vitamin supplements; 12 of them were exposed to prescription medicines, 19 used complementary and alternative medicines, 6 consumed alcohol, one of them smoked cigarettes and another one consumed cannabis (Table 23).

Table 23 Medicines and recreational substances used by participants during pregnancy

Participant ID	Prescription medicines	Over-the-counter medicines	Complementary and alternative medicines	Recreational substances
P1	Metoclopramide	Multivitamins, Rennie	Redbush, Peppermint	Alcohol
P2	N/A	Multivitamins	Homeopathy (Oscillococcinum), Cranberry	N/A
P3	N/A	Multivitamins	Raspberry leaf tea	Alcohol, Cannabis
P4	Amoxicillin	Multivitamins	Redbush, Camomile, Massage	N/A
P5	N/A	Multivitamins	Acupuncture, Yoga, fennel, liquorice, peppermint teas	N/A
P6	Metoclopramide	Multivitamins	Ginger, Raspberry leaf	N/A
P7	Paracetamol	Multivitamins	Homeopathy (Lutenium, Sepia, Nux vomica)	N/A
P8	N/A	Multivitamins	Ginger, Peppermint, Redbush	Alcohol
P9	Cephalexin, Amoxiclav	Multivitamins	Massage, Yoga	N/A
P10	N/A	Multivitamins, Paracetamol	Raspberry leaf, Yoga	N/A
P11	Zineryt, Iron tablets	Multivitamins	Massage	N/A
P12	Paracetamol, Gaviscon, Iron tablets	Multivitamins	Mint tea	N/A
P13	Co-dydramol, Amoxicillin, Fluconazole	Multivitamins, Ranitidine	Mint tea, Yoga	Alcohol
P14	Iron tablets	Folic acid	Acupuncture, Ginger, Camomile, Raspberry leaf	N/A
P15	N/A	Folic acid, Vitamin D, Iron tablets	Raspberry leaf	Alcohol
P16	Metformin	Multivitamins	Reflexology	Cigarette
P17	N/A	Multivitamins	Homeopathy(Melissa), Lemon and Ginger, Acupuncture	Alcohol
P18	N/A	Multivitamins, Folic acid 5mg	Acupuncture, Yoga, Nettle tea	N/A
P19	Metformin, Insulin, Iron tablets, Canesten pessaries	Multivitamins	N/A	N/A
P20	Solpadol, Iron tablets	Multivitamins	Redbush	N/A

4.6.3 Themes

The seventeen themes identified are presented in Table 24 below alongside the theoretical constructs. Other themes which came up but could not be fitted into the model are also included in the last part of the table.

Table 24 Theoretical constructs and the themes identified

Theoretical constructs	Themes
Perceived Severity	Lifestyle changes Mother's health Unborn baby's health
Perceived Risk	Risks of non-adherence (prescription, over-the-counter) Risks of using complementary and alternatives Risks of using recreational substances
Perceived Benefits	Adherence to medicines (prescription, over-the-counter) Effectiveness of medicines (prescription, over-the-counter, complementary and alternatives) Perceived benefits of alcohol consumption
Perceived Barriers	Barriers to non-adherence (prescription, over-the-counter)
Cues to action	Information Trust in conventional or complementary practitioners
Self-efficacy	Difficulty to stop cigarette smoking
Other themes	Experiences of medicine use (prescription, over-the-counter) Communication with healthcare professionals (complementary and alternative medicines, alcohol) Recommending complementary and alternative medicines Friends or family consumption of substances

4.6.4 Lifestyle changes

When asked how often they think about their health in pregnancy, 15 of the women said they do think of their health 'quite often' while others said the thought of their health comes to them 'sometimes'. All the women talked about lifestyle changes related to health and wellbeing such as exercise, energy levels and posture as well as taking healthy diets. They reported eating balanced diets to support their health and the developing child in pregnancy while avoiding what may be harmful to them. In addition, three of them commented on how their medical condition – diabetes - had influenced what they consumed during pregnancy.

> *"Urm mostly if I'm doing the right things for the baby to be healthy, if I'm getting enough exercise. I do a lot of walking…"* (P6)
>
> *"… I try and eat healthily and not take anything that I think will be harmful. I've tried to eat more healthily and drink more water…"* (P10)
>
> *"… so, yes I am trying to cut down on all my sugars and certain foods so I am always thinking about that"* (P16)

One participant communicated her thoughts during and beyond the antenatal period. She said:

> *"Well everything I would say like what I should eat, if I am eating the right things, and obviously other things as well, how am I going to be after pregnancy, with a lot of weight?… I'm reading books about how to care about my baby when she is born…"* (P14)

As a follow up to the previous theme, participants were asked if they were concerned about 2 issues- their health and that of the unborn baby's health.

4.6.5 Mother's health

Nine women expressed different concerns about their health in pregnancy. These concerns were about medical conditions or symptoms of such medical conditions- high blood pressure, low-lying placenta, diabetes, spotting or

bleeding, positive fibronectin test, ‘rare blood type’, pain due to fibroid and fatigue. Four of the nine women expressed concerns about adequate water intake, vitamin and mineral supplements, and weight gain.

> *“Yes the problems are diabetes and because I have a rare blood type as well. I have antibodies in my blood…”* (P19)
>
> *“I worry about getting enough vitamins erm and water”* (P1)

Other participants reported not having concerns about their health and despite the fact that one of these women was diabetic, she did not express any concern. She noted:

> *“Not really because I go up to the hospital often because of the diabetes and I am having more regular scans as well so I am being well looked after”* (P16)

4.6.5.1 The influence of maternal characteristics on the perceptions of mother’s health

Gravidity appeared to be the factor which determined women’s expression of concerns about their health. Most of those who had concerns (6/9) have been pregnant at least once before so they already had some experience of the pregnancy phase. The other 3 women were primigravida who had some issues in early pregnancy which might have given rise to their concerns. They talked about spotting, low blood iron and pain due to fibroid:

> *“…at the beginning of my third month in pregnancy I was spotting and erm I went to the hospital for emergency scan and some tests and they said everything is OK. But it disappeared after, it was maybe because I was working a lot that it happens...”* (P10)
>
> *“There was only one thing, my iron was low and then they sent me another letter saying that I have to have another blood test and the*

> *nurse who took the blood, she said if something very bad they will call me…"* (P14)
>
> *"…my biggest headache is the [fibroid] pain. I think about it a lot, you know, but in reality I can't do anything about it now because of the baby… it's the pregnancy that made it come out, you know it's my first time and before the pregnancy, it wasn't disturbing me. I have to go and look after it after the pregnancy"* (P20)

Most of the women (7/11) who did not report concerns about their health were primigravida. The other 4 women have been pregnant at least once before, and their close relationship with and confidence in the healthcare professionals might have boosted their confidence or allayed their fears:

> *"…he [doctor] is a friend, so I just told him I'm having this problem [nausea] and he said: 'oh just use this one and that one' and that's it. It's as if your brother was a doctor as well and just told you when you're at home having dinner: 'oh well just use this one…"* (P7)
>
> *"…my dad is a doctor and I took his advice as well"* (P13)

4.6.6 Unborn baby's health

Eight of the women had concerns about unborn baby's health as regards preterm delivery and complications which could arise from their medical conditions:

> *"… but urm I'm still worried about like having a preterm baby, I mean if I have it now I'm 28 weeks, it should be fine but it's not ideal still…"* (P1)
>
> *"Yes because I am diabetic and they said that she might (pauses) because they said that she might have to go into neonatal and she might have breathing problems so yes I am concerned about that"* (P19)

However, a participant had a different kind of concern which was related to her food intake in early pregnancy.

> *"Yes, I do worry that I didn't do enough in the start of pregnancy… you know, I just could have eaten more healthily at the beginning"* (P18)

Twelve participants reportedly did not have any concerns about their unborn babies' health for reasons which were related to their confidence in the healthcare professionals, ultra sound scan and test results, as well as the reassurance from foetal movements.

> *"… I think the baby is fairly regularly monitored as well, there is certainly nothing medically that we think would cause any concern"* (P5)
>
> *"… every time I go for scan, they tell me my baby is OK, it's fine. I don't have any, any erm red flags about the baby at all in all the tests I've done. All the tests are always normal so I don't have any concerns at all"* (P20)
>
> *"… she seems OK and she is moving more today so she is OK"* (P14)

4.6.6.1 The influence of maternal characteristics on perceptions of unborn baby's health

Women who had concerns about their unborn baby's health were similar in characteristics to those who did not express concerns. However, 3 women's concerns were especially noted to be related to previous experience of an adverse pregnancy outcome and their medical condition. One woman talked about preterm delivery while the other 2 women's concerns were about diabetes. Since the 3 women had been pregnant at least once before, gravidity might have played a role in their perceptions. They explained their worries:

> *"I think that my last baby was very healthy even though I didn't carry him full term. Urm and I think with this baby as well is very healthy… I had 2 scares in this pregnancy, one was for the blood so I went to get that checked out but I was fine urm they said there was nothing wrong. They tested me for urm platelets and for caffeine and they said it was fine and then erm I had another scare because they did this (pauses) it is quite a new test. The test was for, was called fibronectin,*

which is the protein that you release before you go into labour and I tested positive for it so I had a bit of a scare and then I went back and did another test and I tested negative for it. So I don't know why maybe the test was wrong or just you know (pauses) but urm I'm still worried about like having a preterm baby…" (P1)

"I do yes. I am worried that she might end up having diabetes or that she would end up being (pauses) I was told that with the diabetes the baby could end up being quite big so I am worried about that…" (P16)

"Yes, because I am diabetic and they said that she might (pauses) because they said that she might have to go into neonatal and she might have breathing problems so yes I am concerned about that" (P19)

4.6.7 Prescription medicines

Twelve participants were prescribed medicines at different stages of pregnancy and some of them took more than one medicine.

4.6.7.1 Information

Without exception, all the women received information about one or more of their medicines from health professionals - GP, midwife or pharmacist. The information was mainly about safety of the medicines in pregnancy.

"… whether it was safe for me to take it for the baby and whether it was going to be necessary for me to take it and whether I could look at the balance between not knowing what it could do to the baby and me needing to get better..." (P13)

"I asked whether it was safe to take in pregnancy and they [the GP] said yes" (P4)

Some of the women also got the information about the safety of their medicines from the internet, product leaflets and books although those who claimed to have read the product leaflets could not recall the information contained in it except for one subject who experienced a side effect when using metoclopramide and then went to read up the leaflet. She recounted:

> *"... I got a bit of insomnia so I then got a bit nervous so I thought oh let's just read up on the drug so I read the leaflet which seemed quite intense erm I can't remember all now but it was like it can cause insomnia and this and that and like all these quite serious conditions and don't take with this and don't take with that as they word…"* (P1)

She also went further to get more information about metoclopramide from the internet. She discovered a study which linked the use of metoclopramide to preterm birth and a perceived threat of having another premature child (based on the experience of her first child being premature) made her stop using the medicine:

> *"…so I researched it online and urm I found (pauses) it was a small study but it said that it was linked to preterm birth so I switched off and I stopped taking it for 2 weeks because my first child, a boy was preterm. Urm and then during that stage urm I had, like I've got friends who are midwives and doctors and they were all saying: 'don't listen to the internet and you know, it would be fine and everyone has learnt their lessons from thalidomide' and erm so I went back into the research and I saw that for the one study that I found, it was only done in 175 women and there was another study that was done in 75,000 women erm and that showed no link to premature birth so that made me feel better…"*

The perceived threat of weight loss from her untreated morning sickness made her to seek help and to continue the use of metoclopramide:

> *"… urm and because I was so sick at the time urm I had to move in with my in-laws… I couldn't actually look after my son [first child] and urm and I couldn't keep any food down either, I couldn't keep water down as well, I mean I could throw up like 5 times a day. So urm so I decided that the risk probably wasn't as great as I thought it was and I went back on it. I did have erm 2 other drugs my friend, basically erm it was prescribed by one doctor a shot of erm Valoid [cyclizine], just a one-off injection and I even became sicker, bad decision! I think I was sicker because my body had already gone down, I had lost weight, you know. Then I was also given Valoid suppository and that was before I went back on metoclopramide. Again I went back on metoclopramide because I've done more research…"* (P1)

4.6.7.2 Trust in healthcare professionals

Some of the women also talked about their trust in the healthcare professionals they consulted:

> "*… the diabetic nurse, she was really helpful yes when I first came for my visit and I got a printout from her because she was very nice and she told me how to use it and what it does…* (P19)
>
> *"… I am being well looked after… I was just advised by the midwife about it and that I have to take it twice a day"* (P16)

4.6.7.3 Effectiveness of medicines

Effectiveness of the medicines was the main theme which emerged from asking the women about the benefits of using their medicines. Except one of the participants, all the women verbalised that all their medicines were effective for the indications they were prescribed for:

> *"… it works and each time I stop using it I notice that that yes I have stopped using it because I have acne come back. Since I have been using it, it's worked, the lotion works..."* (P11)
>
> *"Well the amoxicillin was excellent and it cleared the mastitis immediately and that was very good"* (P13)

4.6.7.4 Experiences of medicine use

Most of the participants commented that the medicines were 'fine' when they were asked their experiences of use although a few of them reported some side effects. They remarked:

> *"It was fine. I managed to remember and I didn't have any bad side effects, well I didn't have any side effects so it was fine. I was happy with the experience…"* (P4)
>
> *"… the only thing is it [iron tablets] causes constipation which I have sometimes experienced"* (P11)

Yet one woman did not have any experience to report. She simply responded:

> *"Erm nothing really"* (P14)

4.6.7.5 Adherence to medicines

When participants were asked how they take their medicines, they reported taking them as prescribed. However, when probed further about their experiences of use or thoughts on missed doses, it was discovered that some of them did not adhere to their prescribed medicines.

Eight of them reportedly adhered to one or more of their regimens. They took antibiotics, anti-diabetics, anti-emetics, iron preparations and Canesten pessaries.

> *"Well I think it's quite important to take all the doses when you're taking antibiotics. So I think it's quite an important thing to do... I know you're meant to take the whole course of antibiotics or it might not be so effective next time if you don't finish the course…"* (P4, took amoxicillin)
>
> *"… I am very strict on taking my medicines"* (P19, used metformin, insulin and Canesten pessaries)

4.6.7.6 Risks of non-adherence to medicines

With the exception of two women who declared not having information on the risks of not using their medicines, most of the participants considered that their health or medical condition could get worse if the medicines were not taken. For example, one woman who was prescribed antibiotics noted:

> *"Well no one told me but I suppose, from what I understood, is that the infection gets worse and worse and it won't go away by itself…"* (P9)

Apart from worsening health or medical condition, a respondent expressed concerns about inadequate care for herself and family which can result from not taking her metoclopramide for the pregnancy-related vomiting. She commented:

> *"… urm and then the other risk I think of not taking it is erm it wasn't about the baby but it was about my son [first child] because I was so ill that I couldn't look after him. Urm and I fall asleep in the house and I wake up, finding him, you know, erm upstairs having put all the caps on, having you know, urm put lights on and stuffs and climbing things. Because I was so nauseous from the inset I just didn't know where he's been and what danger he could have got in I mean, just running around. And I couldn't even cook for him properly because any cooking makes me feel sick so I struggle to feed him and he suffered as well, me suffering as well and the baby suffering. So for all those reasons, I just made up my mind that it's just better to go on the drug even though I'd rather not take it but erm it just made sense"* (P1)

4.6.7.7 The influence of maternal perceptions on prescription medicine use

In the group of women who reported adherence to medicines, it was discovered that the reasons for their adherence were due to the fact that either they perceived the severity of their medical conditions to be high, or their perception of the risks of non-adherence was high or they had trust in the healthcare professional whom they had contact with at the time of starting the medicines. They explained:

> *"… before pregnancy I know that I used to have low blood even as a spinster, you know, so if I, you know, maybe I would have started taking it earlier before maybe it would have prevented erm, you know, it would have helped me a little bit than this late stage when I couldn't control (pauses), you know, because all those times I was feeling tired, I was still managing it and when I complained they said take enough rest, because even at that, the rest was not the issue until if I*

> *now sit in a place that is airtight or pressured, I don't feel good any more… Umm, yeah I think I've been stable with the ferrous, yeah I've actually been stable because what was happening to me before that I was erm actually fainting, you know. In as much as they said it was normal but my own was becoming a concern because it was like every now and then so I went to, I talked to the GP, I went for a test and discovered that I had a low blood haemoglobin count… I was, you know, any (pauses), if I stay in a place that is erm airtight, yeah I would just lose consciousness and then I was unnecessarily fatigued, you know, yeah"* (P12, took iron tablets)

> *"… I was so sick that if I didn't (pauses) so even I take it 3 times a day, I would start feeling ill about an hour, an hour and a half before I take my second dose of metoclopramide, so erm I couldn't do without it"* (P6, took metoclopramide)

> *"… the diabetic nurse, she was really helpful yes when I first came for my visit and I got a printout from her because she was very nice and she told me how to use it and what it does…* (P19, used metformin and insulin)

Conversely, other women admitted non-adherence to the physician's prescriptions for different reasons.

- Perceived barriers (forgetfulness and side effects experience),
- Lack of risk perception which can result from non-adherence,
- A low perceived severity of the medical condition, and
- Lack of trust in the healthcare professional were found to explain the participants' behaviours.

As regards the barriers to adherence, one woman commented on her forgetfulness:

> *"Oh, I might have forgotten maybe once or twice erm but I just did the best that I could…"* (P9, took cephalexin and amoxiclav)

Another woman, despite expressing that her greatest concern was the pain due to fibroid, recounted how her experience of the side effects of solpadol

affected her adherence:

> *"… so when I started taking it [solpadol], because of the codeine you know codeine has side effect, I was having constipation, I would be constipated, occasionally I would throw up. So erm I started disliking the medicine because of the side effects because when I take it sometimes I would start feeling uncomfortable so I only take it when necessary… it makes me feel drowsy too"* (P20)

A participant demonstrated her lack of risk perception which can result from non-adherence to iron tablets by saying:

> *"I don't know exactly the risks"* (P14)

One woman who perceived the severity of anaemia to be low remarked:

> *"Well I'm supposed to be taking it one twice a day, but I take it one most of the days because from my own knowledge anyway I don't think I needed to be so compliant with it because my iron is not that low because after the second test my iron was at borderline again and I do take other fruits, things that are rich in iron… it's not only the tablet that increases your iron, other things can increase your iron levels…"* (P11, took iron tablets)

As regards the issue of lack of trust in the healthcare professional, one woman recalled being prescribed 1g paracetamol 6 hourly for cold and high temperature by the GP. She however chose to reduce the dosage herself because according to her, 1g of paracetamol was 'too high'.

> *"… when I had a high temperature, I wanted to make sure and I think I'm a bit more cautious than the recommendation, even here in the UK actually because I think the dose [of paracetamol] is too high… erm well I know what the practice is in my country [France], I thought that in pregnancy it was recommended to use paracetamol as well in my country but the dose is lower… what I'm doing is I'm just trying to use the maximum dose recommended which is the French one which is about half of the UK one…"* (P7, took paracetamol)

There was also an interesting case of a woman who was not convinced that she had been diagnosed correctly. She complained to the GP of blood in her

urine and was given a prescription for amoxicillin which she reportedly did not use but chose an alternative therapy. The lack of trust in her GP and a low perception of severity of her medical condition could be the reason for her behaviour. She reflected on her experience:

> *"… and he [the GP] asked me if I was familiar with urinary infection and stuff and I said no, I never had any, and when I was given the amoxicillin prescription, I even went to the pharmacy to pick the box because I thought ok the doctor said: 'take your course and after one week when you finish the course you come back again and we do a test to see'. So I took the box [of amoxicillin] home and I decided to drink my cranberry juice because I know it has a good impact erm on the urinary erm system and I was drinking almost 2 litres per day and after one week when I did the exam, nothing was found! … if I had a real infection I think I would have taken the antibiotics. My problem with the decision of my doctor was the fact that he asked me about the symptoms I didn't have any symptoms of infection, I did not have any burning while urinating. He asked me all of these things: 'do you have any fever? Are you feeling any pain during urination?' I said no but the fact that I had some blood samples few times erm blood in the urine few times prompted him, you know because he said: 'oh it can be kidney infection' … so because of that I wasn't convinced, I didn't take the medicine because I wasn't convinced by it! …but it might be that the sample he used to make a decision was more concentrated because I wasn't taking enough fluid then, who knows?..."* (P2)

It was also noted that one participant who disclosed 2 medical conditions- diabetes and anaemia- perceived the severity of diabetes to be greater than anaemia and this affected how she took her medicines. She reported adherence to anti-diabetics but not to iron tablets. As regards the iron tablets, she noted:

> *"A few weeks ago they did a blood test when I had a regular check-up, the regular midwife appointments and the blood test results came back and the midwife said that I was under the required level. I don't remember what my iron count is, and that I should take iron tablets because I was a bit anaemic"* (P19)

But she further expressed the fact that she was not too worried about missing her doses of iron tablets:

"… I'm not too worried though about forgetting, I just take it the next day when I remember…" (P19)

4.6.8 Over-the-counter medicines

The most frequently used over-the-counter medicine was folic acid (either singly or in combination with other vitamins) and all the women reportedly took vitamin supplements.

4.6.8.1 Information

Eight participants received recommendations on the importance of taking vitamin supplements during pregnancy by the GP or midwife. Others either took a self-decision to use it or were advised by friends or family members. They noted:

"… it was recommended to me to take folic acid by the midwife…" (P17)

"No one, no one recommended it. Erm I was in Sainsbury's and I saw it but I was checking it because I didn't want to buy any erm vitamins for mum that didn't have calcium, I wanted calcium in it and that one had calcium so that made my decision" (P1)

"… it was a friend that told me about vitamin D and the Pregnacare" (P12)

4.6.8.2 Effectiveness of vitamins

Although the participants recognised that vitamins are supplements which play a crucial role in the development of the baby and health of the mother, almost half of them reported that they were unsure of the effectiveness of the vitamins. They commented:

"Urm honestly, I don't know, they didn't change anything. I don't know whether they are doing something internally but I am not finding or feeling anything in particular. I am just taking them because I just feel that they are good and I needed to take them, not that I am seeing any change or something. But I don't know whether they are doing anything in the body" (P12)

"I haven't noticed anything, I'm assuming that I'm not supposed to necessarily notice. I'm just hoping that it's been beneficial to the baby" (P15)

4.6.8.3 Experiences of vitamin use

Reflecting upon their experiences, most of the women reported that it was 'fine' or 'good' and without side effects:

"Yes, absolutely fine. It's nothing really. I just take it with a meal every day and I just know I am getting my extra vitamins" (P16)

"… I haven't had any bad effects from it, so it's okay so far" (P6)

4.6.8.4 Adherence to vitamins

Only 8 out of the 20 participants admitted taking their vitamin supplements as recommended. Typical responses were:

"Every day, one every day… I just take it in the evenings after I've had my dinner every day… I leave it on the table so I can see it every day" (P10)

"… I mean I'm used to taking the pill everyday so it's not that hard to remember to take it" (P6)

4.6.8.5 Risks of non-adherence to vitamins

Inadequate nutrition and development of the baby was noted by 9 participants as the risks of not using the vitamins. Specifically, they mentioned spinal defects, cleft lip and rickets.

> *"Erm folic acid lack can cause spina bifida something or which is like a curvature of the spine if the baby doesn't have enough folic acid… and the other thing that it can cause is cleft lip urm from a lack of folic acid although I've not heard of how actually they are, I don't know. Everyone tells you take folic acid when you are pregnant or trying…"* (P1)

> *"… the vitamin D I know helps the baby's bones to develop well so deficiency can cause (pauses) rickets, yeah rickets"* (P2)

Other participants admitted not knowing the risks associated with non-adherence to vitamins during pregnancy or that they do not believe in any risk as long as the mother takes healthy diets:

> *"… I don't know if whether you have taken it or not (pauses), whether if you don't take it, the baby will not grow well, I don't know"* (P12)

> *"No there isn't [any risk]. I think it would be fine not to take it as long as you have a decent diet"* (P19)

4.6.8.6 The influence of maternal perceptions on vitamin use

The main influences on adherence to vitamins were perceived barriers (such as forgetfulness) and the lack of perceived risks of non-adherence.

Half of the women reported being forgetful about their supplements or running out of medicines. Reasons given by others for non-adherence included sickness, big size of the tablet, they were 'not good at taking medicines', or that the vitamin was 'just a supplement'. These were the barriers to adherence to the vitamins. In the words of the participants:

> *"Yes, I sometimes forget but I don't think it's a big deal, it's just a supplement, it's not essential. If I miss it a day then I'll miss it a day and I'll carry on…"* (P3)

> *"It's meant to be every day but I don't take it [Pregnacare] every day maybe I only take it like once or twice a week… Well I don't take it regularly because it's too big if not I should be taking it regularly"* (P20)

> *"… I wasn't very good at taking the medicine [vitamins]. I'm meant to be taking them every day and I would say at one point during the pregnancy from about 5 months when I stopped being sick, I took it for about a month and a half almost every day but then I've sort of stopped taking it now… I didn't mean to stop, I just erm ran out of it and haven't bothered to go and get more [laughs].* (P1)

Furthermore, it was observed that most of the participants did not consider or believed in the risks which can result from non-adherence to vitamin recommendations:

> *"I don't know what the risks are for not taking them, I'm sure there are many women out there who don't take any vitamins at all and their children are absolutely fine… I try to remember to eat nice and healthily so you get the same goodness"* (P8)

> *"Well I don't believe that there will be any serious risk because I believe that erm well all those things anyway are things that you get from food, that's what I believe, so if I eat well then I shouldn't worry. If you eat fruits, I eat a lot of fruits, you shouldn't be bothered about all those things"* (P11)

There was however one woman who reported good adherence to her 5mg folic acid in early pregnancy but when she switched to Pregnacare in the second trimester, she became forgetful, developed the perception that it was an 'ordinary supplement' and complained of tablet size. Her adherence to 5mg folic acid was because she perceived the risk of having a baby with cleft lip and palate to be high since she also had a cleft lip and palate at birth. This woman might have learnt that folic acid intake is most essential in the first trimester when the developing baby needs it to grow the neural tube that will eventually form the spine and nervous system. She recalled:

> *"Erm, I used the folic acid 5mg every day up until about 20 weeks or 18 weeks, something like that… it was recommended to me by genetic health screening that I had done a couple of years beforehand because I was born with cleft lip and palate so the consultant who saw me said that at the point of trying to get pregnant plus up to whenever they can exclude cleft lip, which is about 16 weeks, I need to be taking 5mg of folic acid… so once that finished, I just switched to Pregnacare, the usual one"* (P18)

4.6.9 Complementary and alternative medicines (CAM)

Nineteen out of the 20 respondents have used at least one form of CAM therapy for some conditions during pregnancy. These are shown in Table 25 below.

4.6.9.1 Information

Most of the women reported that their friends or family members recommended one or more of the CAM to them. Others got information about the CAM from the internet, product leaflets, CAM practitioners or midwives.

> *"Well because I was having some nausea, first trimester related and one of my friends is basically a doctor and he knows how to prescribe homeopathic remedies… he did have training as well for homeopathic remedies so he told me to use those ones"* (P7)

> *"Well, erm I know that ginger is good for sickness… the acupuncture, once I did the research I'd read that it could be successful so erm I thought I would try it… it was my own choice and I sought out the information. I went to find the information, yes"* (P17)

4.6.9.2 Communication with healthcare professionals

Most of the women did not discuss the use of CAM with their GP or midwife because they felt it was not necessary or important to talk about it. They noted:

> *"Well, I didn't feel there was any need for a discussion on it…"* (P2)

> *"I didn't think it was that important so I didn't say anything"* (P4)

Yet one woman remarked that the consultation time was too short to give room for such a discussion:

> *"Well erm because when I see my midwife it lasts for 5 minutes and there is no discussion really… that's the only reason"* (P7)

A few other women discussed the use of one or more CAM with either the GP or midwife to which the healthcare professionals commented 'good' or 'fine'. They recalled:

> *"I also mentioned it [raspberry leaf] to the midwife and she said yes, that's fine…"* (P10)
>
> *"Yes but they [midwife] actually asked me if I do it [yoga] very often and I said I just do it only periodically here and there so she [midwife] said: 'that's fine, just keeps you going'…"* (P13)

Table 25 CAM therapies and the reported indications for use

CAM modality	Indications/Reasons for use
Cranberry juice	Urinary tract infection
Redbush tea	Health and wellbeing, antioxidant, caffeine-free/alternative to caffeine
Camomile tea	Stomach pains, alternative to caffeine
Fennel tea	Alternative to caffeine, hydration, carminative, indigestion
Liquorice	Alternative to caffeine, hydration, carminative, indigestion
Peppermint tea	Alternative to caffeine, hydration, carminative, indigestion, nausea and vomiting
Ginger tea	Nausea and vomiting, stomach pains, hydration
Nettle tea	To boost iron levels in the body
Raspberry leaf tea	To prepare the uterine muscles for labour, to induce labour
Acupuncture	Nausea and vomiting, health and wellbeing, indigestion, preparation for birth, to induce labour
Yoga	Indigestion, preparation for birth, health and wellbeing, to help with labour, for socialising
Massage	Wellbeing, back ache
Reflexology	Wellbeing, to help with labour
Homeopathy	Flu, nausea and vomiting

4.6.9.3 The influence of maternal perceptions on CAM use

The main influences on CAM use was the women's perception of 'no risks' as well as perceived effectiveness and trust in CAM practitioners. Moreover, most of these women will recommend the CAM they have used to other pregnant women and this is a demonstration of their belief in the CAM.

4.6.9.3.1 Risks of using CAM

When asked what they knew about the risks of using CAM during pregnancy, all of them verbalised that the therapies were natural, and without risks or 'not harmful'. One woman for example who had used a homeopathic remedy in early pregnancy for flu commented:

> *"… so I am just trying to keep myself on the safe side and erm, erm because I have been using that homeopathic remedy erm before being pregnant anyway and the fact that it's all natural just reassured me…"* (P2)

Some other women gave similar comments:

> *"… also I know through experience that herbal teas certainly do you no harm"* (P5)
>
> *"… it's very safe and very good, very beneficial and it's got to be pregnancy yoga, not normal, other types of yoga are not beneficial"* (P9)

4.6.9.3.2 Effectiveness of CAM

In terms of effectiveness, most of the women declared that the CAM used was effective for the different indications:

> *"... so in my first trimester I had erm, erm really bad morning sickness and erm and so I was erm researching on how I can stop being so sick and I read that acupuncture helps so I started having acupuncture and erm I am still having it because it is really helpful. I feel much better for it… well it's all about a belief isn't it? It's whether you believe*

that it works or not I suppose, isn't it? But erm I believe that it definitely helped with my morning sickness" (P14)

"… the peppermint tea was to aid digestion in terms of, you know, it would go down when I was sick if I sipped some peppermint teas into what doesn't agree with me, so I would have it every now and then… the peppermint tea was also helpful especially with the sickness" (P1)

In four other instances, the women felt their therapies were not as effective as they wanted it to be. One woman remarked:

"… oh I don't know somebody said that it [mint tea] was good for your digestion. Occasionally if I've eaten too much like in a restaurant I would drink some mint tea afterwards… but it's probably not effective…" (P13)

Three women said they were uncertain about the effectiveness of raspberry leaf tea which was used to 'prepare the uterine muscles for labour'. One of them noted:

"I don't really know… I haven't really noticed any change to be honest but I figured I might as well" (P6)

4.6.9.3.3 Trust in CAM practitioners

The trust in the practitioners whom the women consulted also came up as a theme. They expressed their confidence in the services received as well as the honesty of the professionals:

"I trust her because you know homeopathy (pauses) a lot of people practice it more like erm from a commercial point of view. I really trust her because she is also a pharmacist and when you have things that erm you know she feels that homeopathy wouldn't help, she tells you…" (P2)

"… I have researched it and I knew she is specialised in working with some people (pauses), she is a professional and as long as the professionals knew what they were doing erm, which she did anyway…" (P17)

One participant even went as far as disclosing what she intends to do if she goes past her estimated date of delivery. She said:

> *"The only thing that I'm planning to do is if I go overdue I don't really want to be induced along the methods that are suggested medically, I'd like to do it homoeopathically. So erm I don't really want to be induced and that's why I'm taking the raspberry leaf for my uterus muscles… Well, the reason I don't want an induced labour is because it increases the risk of a caesarean section and I really, really don't want to have a caesarean section… if it [normal contractions] doesn't come then I'd rather use a homeopathic method of inducing labour than I would use a traditional method… In the homeopathic method, you have a consultation with a homeopath for about half an hour, 45 minutes and then they ask you questions about yourself, your health, everything and erm then they suggest a form of homeopathic remedy that can induce the child. A friend of mine had this done and it worked for her really well, although she did panicked a little bit when it happened anyway. I'd rather trust that than I would be induced in another way…"* (P15)

4.6.9.3.4 Recommending CAM

A higher proportion of the participants said they would recommend one or more of their CAM therapies to another pregnant woman. Some of them said:

> *"Yes I would recommend all of them…"* (P5)
>
> *"Yes I would… well like I said the person I went to see, she was also very good, it was a very good consultation as well so it [acupuncture] was a positive experience"* (P18)

Some women admitted that they will not recommend one or more of the CAM they have used to another pregnant woman due to perceived ineffectiveness or because they felt therapy needs to be individualised:

> *"… No because the raspberry leaf tea is not doing anything"* (P10)
>
> *"No I wouldn't because I'm not a doctor so I wouldn't say, I would say well really you should go and see your doctor who is specialising in that and erm then she will be able to find something for you but I*

wouldn't say to you use this and that really because I think also it's very different depending on people as well, so no…" (P7)

Yet, a few other participants said they were not sure they would recommend to another pregnant woman:

"Maybe, probably. I'm not sure…" (P3)

"The ginger I am not quite sure about…" (P14)

4.6.10 Alcohol

4.6.10.1 Information

Only six participants disclosed taking 1 or 2 units of alcohol per week. The women spoke about friends and family, internet, media, pregnancy book and health professionals- GP and midwife- as their sources of information on alcohol in pregnancy. The main information reported was about the perception that occasional intake of alcohol during pregnancy was permissible.

4.6.10.2 Communication with healthcare professionals

When asked whether there were discussions about alcohol in pregnancy with healthcare professionals, all replied in the affirmative although 4 women did not disclose consumption. They remarked:

"… they ask you whether you smoke and I said, 'no', and they ask you whether you drink and I said, 'no'. I think I don't look very naive so I don't think they feel that I need to be told" (P13)

"They asked me if I was smoking and drinking and I said 'no'. So they obviously didn't see me as a case to worry about so, not really. No I'm not smoking and I don't even know if (pauses) I have the occasional glass of wine but a maximum of two a week though I haven't really mentioned it but I haven't been told (pauses), I haven't really been told that you shouldn't really be drinking" (P15)

The 2 other subjects however reported that they received 'positive' feedback during their discussion with healthcare professionals:

> *"… I told the midwife I have alcohol every now and then and they are like: 'oh that's fine'…"* (P1)

> *"… from talking to doctors, midwives and everything they've said after the first trimester, it's not necessarily going to be harmful to the baby…"* (P8)

4.6.10.3 The influence of maternal perceptions on alcohol consumption

In this group of women, there was perception of some benefits in drinking. This perception, alongside their low perceived risk of drinking as well as the influence of friends or family consumption seemed to explain their behaviour.

4.6.10.3.1 Perceived benefits of consumption

The reasons given by the women for drinking alcohol were because they liked it and it is relaxing:

> *"I enjoy it. I like the taste…"* (P13)

> *"… a glass of wine every now and then I think is relaxing and the actual effects of the alcohol could sometimes outweigh the effects of the scotch and alkanol in it [laughs]…"* (P1)

4.6.10.3.2 Risks of alcohol consumption

All the six women believed that one or two units of alcohol per week as a reasonable level of consumption in pregnancy. In their words:

> *"… I believe that in moderation it's absolutely fine… I have like 2 glasses of wine per week …but erm yeah, I am not erm I don't really lecture on it though like I think erm as a mum, you sort of feel what's good and you feel what's not good for you, your body would crave certain things and if it's not good, your body would not want to take it. And sometimes even when I told you I've had some cider at one time*

> *erm I started drinking it, I felt a bit sick and I couldn't finish a glass of it. So that's it..."* (P1)
>
> *"… I've read quite a lot since I've been pregnant so that's backed up by stuff that I've read as well. And erm the NHS pregnancy book actually allows you to drink a glass or 2 small units of wine twice a week"* (P15)

When probed further about the risks of alcohol intake during pregnancy, most of the women seemed to ignore answering it by expressing the common belief that small intake of alcohol would not adversely affect the unborn baby. They verbalised their perceptions:

> *"Erm well, I don't believe that there is any harm to the baby from the occasional glass of wine, that's what I know"* (P13)
>
> *"My mum drank, not like heavily through her pregnancies with my sister and I but she would have a drink and my partner's mum would have a drink and in fact most of my parents' friends and my uncles and aunties and stuff they said they had all drunk and we are all perfectly fine. In fact some of my cousins are highly intelligent people, so yes there can be risks but I think they are few and far between"* (P8)

Additionally, 2 women admitted the fact that alcohol can actually have adverse effects on the baby only if large amounts are consumed:

> *"…Well I do know if you drink too much, you can cause quite a lot of extensive damage to the baby… probably brain development and things like that as well, there can be problems with that"* (P8)
>
> *"… because I've been having a glass of wine occasionally I don't really see that as really, really bad. Obviously alcohol in excess is a very, very bad thing for the body… it's bad, yes, it's toxin isn't it? Basically, if you're putting toxins into your body the toxins are also going to be transferred to your baby …"* (P15)

Two women also tried to justify that alcohol consumption was still 'better' than smoking during pregnancy:

> *"…I don't smoke anyway, I'm paranoid about smoking now or being around any kind of smoke because I don't want preterm again. Urm and I know smoking limits the amount of oxygen in the blood for the baby"* (P1)

> *"I know that when you smoke the oxygen levels that are getting to your baby are lowered… I see smoking as the worst thing possible"* (P15)

4.6.10.3.3 Friends or family consumption

All the participants had friends or family members who consume alcohol and they reported being influenced by them. One of the women even explained how she could not resist drinking because her partner and other family members drink:

> *"He [partner] does… it's like quite difficult, especially when your partner drinks and you've got other people drinking around you and loads around you and you are not doing anything, it's quite hard not to but, like my partner's mum, my mum, my dad…"* (P8)

> *"… then I also have cider when I'm out with friends and on some weekends when we socialise"* (P1)

4.6.11 Cigarette

The only subject interviewed about cigarette said she reduced her intake to 4 or 5 sticks per day and that her partner also smokes. Despite acknowledging the risks to the foetus, she verbalised her lack of self-efficacy- she found it difficult to stop smoking:

> *"… it's obviously bad for baby because of all the carbon monoxide that would be in my system and she would be taking it in… it is best for my baby to stop obviously but it is very hard. I've been smoking for a long time"* (P16)

She further demonstrated the lack of self-efficacy to stop smoking when she was referred to a stop smoking clinic and was given nicotine patches. She used the patches for about a month and stopped because of perceived ineffectiveness. She noted:

> *"… I used them [nicotine patches] for maybe a month or so… they didn't really work. It didn't really work for me anyway, I was still craving"* (P16)

4.6.12 Cannabis

Only one participant was interviewed about cannabis. She claimed to have reduced her consumption during pregnancy to once a month and her partner also consumes the substance. When asked about the information on cannabis in pregnancy, the participant simply said she is an 'informed' person who does not consume much. She felt that healthcare professionals target people who consume large amounts:

> *"… I'm an informed person and I do know the limits. Then also because I don't consume that much, they don't question you that much I think. I imagine they target people that are consuming large amounts"* (P3)

However, despite claiming to be an 'informed' person, the participant reported not knowing much about the risks of taking cannabis in pregnancy.

Table 26 summarises the theoretical constructs which could be used to predict or explain participants' behaviour with regard to medicine and recreational substance use during pregnancy.

Table 26 Summary table of results

Medicine/Substance	Predictors of behaviour
Prescription medicines	**Adherence:** High perceived severity of medical condition High perceived risks of non-adherence Trust in healthcare professional **Non-adherence:** Perceived barriers (forgetfulness and side effects experience) Lack of trust in healthcare professional Low perceived severity of medical condition Lack of perceived risks of non-adherence
Over-the-counter medicines (Vitamins)	**Non-adherence:** Perceived barriers (forgetfulness) Lack of perceived risks of non-adherence
Complementary and alternative medicines	Perceived effectiveness Lack of perceived risks of therapies Trust in CAM practitioner
Alcohol	Low perceived risks of consumption Perceived benefits Friends or family consumption
Cigarette	Low perceived risks of smoking Lack of self-efficacy Friends or family consumption
Cannabis	Lack of perceived risks of consumption Friends or family consumption

4.7 Discussion

A broader understanding of women's health beliefs and perceptions of medicine and recreational substance use during pregnancy is necessary such that medical services can be tailored appropriately for them. In this qualitative study, the beliefs of expectant mothers about their health as well as medicine and recreational substance use in pregnancy were investigated using the Health Belief Model as the framework.

It is however challenging to compare the findings of the present study with previous work due to the differences in study objectives and data collection methods. Furthermore, there are no comparative data available as regards the qualitative assessment of the beliefs of pregnant women using the Health Belief Model, hence this is the first of its kind.

All the participants in the present study reported lifestyle modifications as regards diet, exercise and avoidance of harmful substances. Almost half of the participants expressed concerns about their health in terms of adequate vitamin and water intake as well as medical conditions such as high blood pressure and diabetes. Most of the women who had concerns about their health have been pregnant at least once before. The women who reported concerns about their unborn baby's health were either those who had prior experience of an adverse pregnancy outcome and thus worried about the outcome of the current pregnancy, or those who had medical conditions which they feared might affect the unborn baby. These data highlight the knowledge of the women about the importance of lifestyle changes during pregnancy.

An important theme of adherence came up with respect to prescription medicines and vitamin use during pregnancy. Adherence to medicines is defined as the extent to which the patient's action matches the agreed recommendations. Non-adherence may limit the benefits of medicines, resulting in lack of improvement, or deterioration in health (NICE guideline, 2009).

The present study found that a high perception of the severity of a medical condition, trust in the healthcare professional, a high perception of the risks which can result from not taking medicines, and perceived barriers such as forgetfulness and side-effects experience were the predictors of adherence to prescribed medicines amongst pregnant women.

The current study also indicated that perception of the risks which can result from not taking vitamins and perceived barriers such as forgetfulness were the predictors of adherence to vitamin recommendations. Women who were forgetful to take their vitamins, those who were not aware of the risks or who believed there were no risks associated with non-adherence tended not to take their vitamin supplements as recommended. The reason for the latter perception could be because vitamins were used for preventive purposes as some of them pointed out that they were uncertain about the effectiveness of the supplements.

With regard to complementary and alternative medicine (CAM) use, the present study found that trust in CAM practitioners whom the women consulted and the confidence in the CAM services received influenced women's use of the therapies. Most of the participants will recommend the

CAM they have used to other pregnant women. Furthermore, all the respondents in this study felt the CAM they have used had no risks in pregnancy. A possible explanation for this perception may be that women are aware of the potential teratogenic effects of some medicines and therefore take responsibility for their health and the unborn baby's health. This corroborates the finding by Gaffney and Smith (2004) which demonstrated that majority of the 220 study participants believed the use of CAM to be safe during pregnancy. Most of the women in the current study also believed in the effectiveness of the CAM they have used and this is in keeping with the research by Fakeye and colleagues (2009) which showed that 81% of the 595 participants believed in the efficacy of herbal medicines.

The present study found that the participants who took alcohol had low perceived risks of consumption on the baby since they believed that consuming a few units of alcohol during pregnancy was reasonable and that only large amounts can harm the developing foetus. This finding is not far removed from the results of past studies on alcohol consumption in pregnancy (Baric and MacArthur, 1977; Barbour, 1990; Lelong et al., 1995; Kesmodel and Kesmodel 2002; Toutain 2010; Kim and Park 2011; Jones and Telenta 2012). Furthermore, it was observed that some women in the present study compared alcohol intake favourably to smoking during pregnancy. This is not unexpected as research suggests that people compare themselves with counterparts who engage in other unhealthy behaviours and by so doing, one can appear more advantaged than others (Lawson, 1994). All the participants also perceived the benefits of relaxation and enjoyment from alcohol consumption during pregnancy. This finding

lends support to the work of Raymond et al. (2009) which reported that pregnant women described alcohol consumption as being beneficial with regard to stress relief and relaxation. The current study also found that the participants who consumed alcohol reported having family members or friends with whom they drank. This is consistent with a prior study- Senecky et al. (2011) noted that there was a direct relationship between pregnant woman's drinking habits and those of her spouse or partner.

The only participant in this study who admitted smoking during pregnancy had a low perceived risk of smoking on the developing child. Despite her referral to the stop smoking clinic where she was given nicotine patches, this participant lacked the self-efficacy to stop. According to her, she found it difficult to stop because she had been smoking for years and that the nicotine patches were not effective since she was still craving for cigarettes while using it. Additionally, she reported that her partner also smokes and this could also influence her to smoke as previous research found that women who smoked during pregnancy lived in homes with significantly more smokers than in the homes of non-smoking women (Steyn et al., 1997).

The only participant who disclosed cannabis use claimed to be an informed person but expressed lack of knowledge of the risks of consumption during pregnancy. However, an explanation for this participant's attitude is that she probably declared not knowing the risks of cannabis on the unborn baby in order to justify her unhealthy behaviour.

Another important finding from the present study was about the sources of information on medicine and recreational substance use in pregnancy. The internet is one of the fastest-growing sources of information on a wide range

of health-related issues, including pregnancy (Lagan et al., 2006). However, women find a lot of conflicting information on the internet which are often not evidence-based (De Santis et al., 2010). Even the evidence-based studies require being a professional in the field to be able to discern and apply the results. The widespread use of this source was demonstrated by a participant in the present study whose fear of the safety of her medicine seemed to be confirmed by the results of a study which she read online. Therefore, the role of healthcare professionals as a source of evidence-based information on medicine and recreational substance use during pregnancy cannot be over-emphasized. Moreover, trust in the healthcare professional was observed as one of the factors which influenced the use of prescription medicines during pregnancy.

4.8 Strengths and Limitations

Some limitations need to be considered when interpreting the results from this study. The validated tools which are used for smoking and alcohol intake were not incorporated in the interview guide design. The analysis of prescription medicines was not classified into medicines for acute or chronic conditions, and data saturation was not achieved with the medicines and recreational substances studied. Furthermore, qualitative research is based on interpretation which necessarily requires input from researchers (Wulandari and Whelan, 2011), hence it is possible that the researcher's personal experience as a pharmacist and mother may have influenced the interpretation of the data. However, the likelihood of this is low as a male researcher who is single was involved in developing the coding framework and the interpretative processes of the themes and this helped to establish

the confirmability of the results. This study was conducted in a central London teaching hospital with participants who were mainly whites and university-educated. The use of a purposive sample and the voluntary nature of participation in the study also meant that the study sample may differ from the general population in their beliefs or perceptions about medicine or recreational substance use during pregnancy. Hence the results may not be transferable to other populations.

However, despite the fact that the study sample limits transferability of the results to a broader population, the women's concepts, beliefs, perceptions and ideas about prenatal use of medicines and recreational substances were insightful and provided important information which will be useful for healthcare professionals and researchers. The other strengths of this study lie in the data collection method employed. The semi-structured interview method provided the rigour needed to ensure that perceptions related to the research questions were explored while allowing flexibility for the participants to bring up other issues which were important to them but not covered by the interview guide. The interviewer had been following up the women from their first trimester, hence participants were confident discussing with her. The telephone interviews were also fixed at convenient times for the interviewees, therefore enabling them to communicate openly with the interviewer. The sampling procedure, data collection and analysis were appropriately explained in order to establish the trustworthiness of the results.

4.9 Conclusions

This study demonstrates that expectant mothers choose to take responsibility for their health and the unborn child's health. In making decisions about medicine use in the antenatal period therefore, expectant mothers consider many factors including the severity of a medical condition for which the medicine is indicated, the risks of non-adherence to the medicine as well as the anxiety about the risks of medicines on the developing foetus. With regard to prenatal use of recreational substances, a low or lack of risk perception could be used to explain the unhealthy behaviour. Most of the women in this study needed more information about the benefits or risks of prenatal use of medicines or recreational substances. Although knowledge alone does not guarantee compliance with healthy behaviours, it does allow women to make informed choices. Healthcare professionals should make every effort to protect the health of pregnant women and the unborn babies through the provision of appropriate evidence-based counselling which is guided by women's perceptions.

CHAPTER 5 - DISCUSSION AND CONCLUSION

5.1 Introduction

The vulnerability of the foetus to the adverse effects of medicines and recreational substances during pregnancy attracts huge attention from researchers and healthcare professionals because of the highly publicised incidents such as thalidomide and diethylstilboestrol experiences.

The inclusion of pregnant women in clinical trials to test the teratogenic properties of medicines is not possible due ethical reasons. Yet, expectant mothers do have chronic and acute medical conditions which may require medicines. Therefore, epidemiological approaches to risk evaluation are of major importance in order to improve the evidence base for using medicines in pregnancy. It has also been proposed that most pregnant women are sensitive to the risks of medicines for the unborn baby (Baric and MacArthur 1977); and that little is known about women's health beliefs about medicines and recreational substances in pregnancy (Heaman et al., 2004).

Although the volume of literature on the use of medicines and recreational substances in pregnancy has been growing, there remain concerns about the limitations of previous researches. A literature review of epidemiological studies discovered that there is limited data on the full extent of prenatal medicine (prescription, over-the-counter, and complementary and alternative medicines) and recreational substance (licit and illicit substances) use and their effects on pregnancy outcomes (section 1.2.6.4). The international literatures also demonstrate that there is scarcity of information on pregnant women's in-depth beliefs about their health and medicine and recreational substance use (section 3.6). Thus, the overall aim of this thesis was to investigate medicine and recreational substance use in pregnancy. The

objectives were to determine medicine and recreational substance use during pregnancy (first, second and third trimesters) as well as the pregnancy outcomes; and to qualitatively assess the health beliefs of the same antenatal population of London using the Health Belief Model as the framework. In this chapter, a discussion of the main findings described in this thesis will be presented along with the implications, recommendation for future research, and conclusions.

5.2 Main findings

5.2.1 Medicine and recreational substance use in pregnancy

There are no comparable UK studies for the prevalence of prescription, over-the-counter, complementary and alternative medicines as well as alcohol use in the first trimester which employed the same methods as the current study. Internationally, there are no comparable studies for the prevalence of cigarette smoking and illicit substance use in early pregnancy which used the same methods as the current study.

The use of medicines in this antenatal population is reportedly more common than recreational substances. Participants who used medicines or alcohol were more likely to be university-educated or in the age range of 31 – 40 years while users of cigarette were more likely to have education which is below the university level.

The results obtained from assessing the safety knowledge of the mothers demonstrated that although a high proportion of the women felt they had enough information about the safety of recreational substances, a substantial

number of them believed they had little or no information about the safety of medicines in pregnancy (section 2.6.2.4).

With regard to the pregnancy outcomes, concomitant use of complementary and alternative medicines with cigarette in the first trimester was univariably associated with an increased risk of congenital anomaly in the baby ($p = 0.001$). The use of complementary and alternative medicines jointly with over-the-counter medicines in at least one trimester was also univariably associated with a higher risk of congenital anomaly in the baby ($p = 0.001$). Comparable results on concomitant use of these agents and associations with pregnancy outcomes were not found in previous international studies. However, due to the limited sample size of the cohort, logistic regression could not be carried out to control for potential confounders. Hence, the results should be regarded as preliminary and further investigation is necessary.

5.2.2 Qualitative study on health beliefs

There are no comparative data available internationally as regards the qualitative assessment of the health beliefs of pregnant women using the Health Belief Model. The findings from this study showed that all the participants in the qualitative study reported lifestyle modifications as regards diet, exercise and avoidance of harmful substances. Almost half of the participants expressed concerns about their health in terms of adequate vitamin and water intake as well as medical conditions such as high blood pressure and diabetes. Most of the women who had concerns about their health have been pregnant at least once before. The women who reported concerns about their unborn baby's health were either those who had prior

experience of an adverse pregnancy outcome and thus worried about the outcome of the current pregnancy, or those who had medical conditions which they feared might affect the unborn baby.

The findings indicated that a high perception of the severity of a medical condition, perceived barriers such as forgetfulness, trust in the health care professional and a high perception of the risks which can result from not taking medicines were observed to explain the behaviour of women as regards adherence to prescribed medicines. Women who perceived the severity of their medical condition (for instance diabetes) to be high, those who trusted the information and services received from healthcare professionals or those who perceived a risk from not using their medicines were more likely to adhere to their prescribed medicines.

Folic acid and other vitamins were the main over-the-counter medicines described in this part of the thesis. Participants who perceived barriers such as forgetfulness to take the vitamins, those who were not aware of the risks or who believed there were no risks associated with non-adherence were more likely not to take their supplements as recommended.

The results about complementary and alternative medicines (CAM) demonstrated that all the participants believed that the therapies constitute no risk to the unborn child. Most of them also believed in the effectiveness of CAM as well as trusted the CAM practitioner which they consulted.

The participants who took recreational substances- alcohol, cigarette or cannabis- perceived little or no risks of consumption on the developing foetus. It was discovered that most of the women in this study needed more

information about the benefits or risks of prenatal use of medicines or recreational substances.

Another important finding from this study is the trust in healthcare professionals which influenced the use of prescription medicines during pregnancy. This confirms that healthcare professionals play a pivotal role in providing evidence-based information about the prenatal use of these agents.

Overall, this study is suggestive that the Health Belief Model is a useful model for explaining and predicting health-related behaviours in the pregnant population. However, as pointed out by the critics of the model, friends or family consumption of recreational substances (alcohol, cigarette or cannabis) which came up as a predictor for use, is an environmental influence on health behaviour which the model did not consider in its constructs.

5.3 Implications for practice and policy

The findings presented in this thesis have some implications for healthcare professionals caring for pregnant women and for policy makers.

First, healthcare professionals have a role in educating reproductive age women about the safety of medicines as well as counselling against unnecessary exposures to over-the-counter and complementary and alternative medicines which can pose a risk to the foetus. Furthermore, because of the potential for herbals to interact with conventional medicines (McLay et al., 2012), routine screening and counselling about herbals and other CAM modalities should become part of antenatal visits.

Second, policy makers also need to ensure that there is proper and efficient documentation of the safety of complementary and alternative medicines in pregnancy.

Third, it has been suggested that there is an erroneous assumption by healthcare professionals that women are aware of the foetal risks of substance use during pregnancy and therefore do not need to be educated about it (Griffiths et al., 2005). Thus, it is necessary for health care providers to provide appropriate advice for pregnant women at risk for using recreational substances, on the benefits of quitting since the negative outcomes caused by these agents are preventable.

Fourth, non-adherence to prescribed or recommended medicines may represent a loss to patients, the healthcare system and society (NICE guideline, 2009). This is because some prescribed or recommended medicines can help in preventing birth defects or other adverse pregnancy outcomes. Hence, healthcare professionals need to appropriately advise pregnant women about the benefits of adherence to prescribed or recommended medicines during pregnancy.

Lastly, healthcare professionals need to take the time to find out about health beliefs of women and to adopt a sensitive and non-judgemental approach when enquiring about medicine or recreational substance use during pregnancy in order to earn the trust of their patients. The perspectives, beliefs, concerns and experiences of expectant mothers should be taken seriously during counselling because it could make the communication of benefits and risks in healthcare settings more effective. Furthermore, there could be more productive discussions which can serve as an avenue for

passing other relevant messages across to the women. This will enable the women to make informed decisions which can help in minimising risks.

5.4 Further work

First, further research is necessary as regards the effects of concomitant use of medicines and recreational substances during pregnancy on pregnancy outcomes. Such studies would need to be of larger sample sizes, and also consider the dose and duration of exposures to these agents. The studies would also need to statistically control for potential confounders including maternal medical conditions or illnesses during pregnancy and exposure to environmental toxins and chemicals as these may also adversely affect pregnancy outcomes.

Second, congenital anomalies may go undetected clinically until some years after birth such as in the case of diethylstilboestrol. Therefore, a follow-up of children who have been exposed to medicines and recreational substances in pregnancy will be necessary in order to detect the long term effects of such exposures.

Third, in this thesis, recreational substance use was assessed by self-report, and future investigation could involve the use of biochemical verification in which other methods such as blood, urine, breathe or meconium analyses may be used to assess exposure status. These objective screening methods could add more information to self-report use of recreational substances.

Fourth, as demonstrated in this thesis, the field of risk or safety perception and communication is important. Thus, it would also be interesting to

investigate how information on safety, risk and benefits of pregnancy exposures to medicines and recreational substances is provided to expectant mothers by midwives and other healthcare professionals.

Lastly, further research is also needed to explore the relationship between health beliefs and health behaviours over the course of pregnancy. Hence, longitudinal research would be helpful in examining the associations between women's intentions to improve health behaviour and actual behavioural change. In this regard, it may be necessary to develop an assessment tool with which healthcare professionals can identify individual health beliefs early in pregnancy. Consequently, relevant clinical interventions can be developed in order to safeguard maternal and foetal health.

5.5 Conclusions

The work described in this thesis investigated the epidemiology and health beliefs of medicine and recreational substance use during pregnancy in London, UK.

This thesis is an original contribution to knowledge as it is the first study to qualitatively assess the health beliefs in an antenatal population using a theoretical framework. It is also the first study to report the effects of concomitant use of medicines and recreational substances on pregnancy outcomes. It is the first UK study to prospectively examine exposures to all medicines and recreational substances during the course of pregnancy using a structured interview approach. Furthermore, it is the first UK study to assess the safety knowledge of pregnant women about medicines and recreational substances.

The key findings in this thesis are summarised below:

- The use of medicines in this antenatal population is reportedly more common than recreational substances.
- Women who used medicines or alcohol were more likely to be university-educated or in the age range of 31 – 40 years while users of cigarette were more likely to have education which is below the university level.
- The thesis was not powered (in terms of sample size) to demonstrate an association between the medicines and recreational substances used during pregnancy and increased risk of congenital anomalies in the baby.
- Pregnant women choose to take responsibility for their health and the unborn child's health.
- Pregnant women's adherence to medicines could be explained by women's perception of the severity of a medical condition for which the medicine is indicated, risks of non-adherence to the medicine as well as the anxiety about the risks of the medicine on the developing foetus. In the case of recreational substance use, a low risk perception could be used to explain women's behaviour.
- Most of the participants needed more information about the benefits or risks of medicines and recreational substances in pregnancy.
- Healthcare professionals are most suited to provide appropriate evidence-based information to pregnant women.

- The Health Belief Model is a promising framework which health agencies, healthcare professionals and researchers can adopt in assessing health beliefs.

In conclusion, the findings from this thesis provide essential insights for those providing maternity care as it demonstrated that prenatal use of medicines and recreational substances is crucial, not only because of the potential risks to the unborn child, but because of the benefits to the mother and baby which some medicines provide during pregnancy. It has therefore improved the evidence base on the subject matter and it is an important contribution to the effective healthcare of pregnant women as well as the protection of maternal and foetal health.

REFERENCES

Abasiubong, F., Bassey, E. A., Udobang, J. A., Akinbami, O. S., Udoh, S. B. and Idung, A. U. 2012. Self-medication: potential risks and hazards among pregnant women in Uyo, Nigeria. *Pan African Medical Journal,* 13, 15.

Adusi-Poku, Y., Edusei, A. K., Bonney, A. A., Tagbor, H., Nakua, E. and Otupiri, E. 2012. Pregnant women and alcohol use in the Bosomtwe district of the Ashanti region-Ghana. *Afr J Reprod Health,* 16, 55-60.

Alexiades, M. N. 1996. Selected guidelines for ethnobotanical research: A field manual (editor). *The New York Botanical Garden, New York.*

Ali, N. S. 2002. Prediction of coronary heart disease preventive behaviors in women: A test of the Health Belief Model. *Women & Health,* 35 (1), 83-96.

Al-Riyami, I. M., Al-Busaidy, I. Q. and Al-Zakwani, I. S. 2011. Medication use during pregnancy in Omani women. *Int J Clin Pharm,* 33, 634-641.

American Psychiatric Association. 2007. Treatment of patients with substance use disorders, second edition. *Am J Psychiatry,* 164, 5-123.

Anderson, D. M., Keith, J. And Novak, P. D. (editors). 2002. Mosby's medical, nursing, and allied health dictionary 6th edition. *St. Louis, MO: Elsevier,* p. 784.

Andrade, S. E., Raebel, M. A., Brown, J., Lane, K., Livingston, J., Boudreau, D., Rolnick, S. J., Roblin, D., Smith, D. H., Dal Pan, G. J., Scott, P. E., and Platt, R. 2008. Outpatient use of cardiovascular drugs during pregnancy. *Pharmacoepidemiol Drug Saf,* 17, 240-247.

Andrade, S. E., Gurwitz, J. H., Davis, R. L., Chan, K. A., Finkelstein, J. A., Fortman, K., McPhillips, H., Raebel, M. A., Roblin, D., Smith, D. H., Yood, M. U., Morse, A. N. and Platt, R. 2004. Prescription drug use in pregnancy. *Am J Obstet Gynecol,* 191, 398-407.

Armitage, C. J. 2009. Is there utility in the transtheoretical model? *British Journal of Health Psychology,* 14, 195-210.

Armitage, C. J. and Conner, M. 2000. Social cognition models and health behaviour: A structured review. *Psychol Health,* 15, 173-189.

Aviv, R. I., Chubb, K. and Lindow, S. W. 1993. The prevalence of maternal medication ingestion in the antenatal period. *S Afr Med J,* 83, 657-660.

Baggley, A., Navioz, Y., Maltepe, C., Koren, G. and Einarson, A. 2004. Determinants of women's decision making on whether to treat nausea and vomiting of pregnancy pharmacologically. *J Midwifery Womens Health,* 49, 350-354.

Bakker, M. K., Jentink, J., Vroom, F., Van Den Berg, P. B., De Walle, H. E. and De Jong-Van Den Berg, L. T. 2006. Drug prescription patterns before, during and after pregnancy for chronic, occasional and pregnancy-related drugs in the Netherlands. *BJOG,* 113**,** 559-568.

Bandura, A. 1977. Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review,* 84, 191-215.

Banerjee, B. 2009. Information, education, and communication services in MCH care provided at an urban health center. *Indian Journal of Community Medicine,* 34, 298-300.

Baraka, M. A., Steurbaut, S., Coomans, D. and Dupont, A. G. 2013. Ethnic differences in drug utilization pattern during pregnancy: a cross-sectional study. *J Matern Fetal Neonatal Med,* 26 (9), 900-907.

Baranowski, T., Perry, C. L. and Parcel, G. S. 1997. How individuals, environments, and health behavior interact: Social Cognitive Theory. In: Glanz, K., Lewis, F. M. and Rimer, B. K. (editors). Health Behavior and Health Education: Theory, Research, and Practice, 2nd edition. *San Francisco, CA: Jossey-Bass Inc,* 153-178.

Barbour, B. G. 1990. Alcohol and pregnancy. *J Nurse Midwifery,* 35**,** 78-85.

Baric, L. and Macarthur, C. 1977. Health norms in pregnancy. *Br J Prev Soc Med,* 31**,** 30-38.

Bauer, C. R., Shankaran, S., Bada, H. S., Lester, B., Wright, L. L., Krause-Steinrauf, H., Smeriglio, V. L., Finnegan, L. P., Maza, P. L. and Verter, J. 2002. The Maternal Lifestyle Study: drug exposure during pregnancy and short-term maternal outcomes. *Am J Obstet Gynecol,* 186**,** 487-495.

Bello, F. A., Morhason-Bello, I. O., Olayemi, O. and Adekunle, A. O. 2011. Patterns and predictors of self-medication amongst antenatal clients in Ibadan, Nigeria. *Nigerian Medical Journal,* 52 (3), 153-157.

Bercaw, J., Maheshwari, B. And Sangi-Haghpeykar, H. 2010. The use during pregnancy of prescription, over-the-counter, and alternative medications among Hispanic women. *Birth,* 37**,** 211-218.

Bernard, H. R. 2002. Research methods in anthropology: Qualitative and quantitative methods. 3rd edition. *AltaMira Press, Walnut Creek, California.*

Berthier, M., Bonneau, D., Perault, M. C., Oriot, D., Chabot, F., Maillauchaud, M. C., Magnin, G. and Vandel, B. 1993. Medications exposure during pregnancy. A study in a university hospital. *Therapie,* 48**,** 43-46.

Bertoldi, A. D., Dal Pizzol, T., Camargo, A. L., Barros, A. JD., Matijasevich, A. and Santos, I. S. 2012. Use of medicines with unknown fetal risk among parturient women from the 2004 Pelotas Birth Cohort (Brazil). *Journal of Pregnancy,* 1-11.

Bessa, M. A., Mitsuhiro, S. S., Chalem, E., Barros, M. M., Guinsburg, R. and Laranjeira, R. 2010. Underreporting of use of cocaine and marijuana during the third trimester of gestation among pregnant adolescents. *Addict Behav,* 35**,** 266-269.

Bishop, J. L., Northstone, K., Green, J. R. and Thompson, E. A. 2011. The use of complementary and alternative medicine in pregnancy: data from the Avon Longitudinal Study of Parents and Children (ALSPAC). *Complementary Therapies in Medicine,* 19, 303-310.

Black, R. A. and Hill, D. A. 2003. Over-the-counter medications in pregnancy. *Am Fam Physician,* 67, 2517-2524.

Bladh, M., Josefsson, A., Carstensen, J., Finnstrom, O., Sydsjo, G. 2013. Reproductive patterns among twins – a Swedish register study of men and women born 1973-1983. *BMC Pregnancy and Childbirth,* 13, 6.

Bonassi, S., Magnani, M., Calvi, A., Repetto, E., Puglisi, P., Pantarotto, F. and Lazzaroni, F. 1994. Factors related to drug consumption during pregnancy. *Acta Obstet Gynecol Scand,* 73**,** 535-540.

Bookwala, A., Hussain, N. and Bhandari, M. 2011. The three-minute appraisal of a prospective cohort study. *Indian J Orthop,* 45 (4), 291-293.

Boynton, P. M. 2004. Hands-on guide to questionnaire research: Administering, analysing and reporting your questionnaire. *BMJ,* 328, 1372-1375.

Bradburn, N. M. and Sudman, S. 1979. Interviewer variation in asking questions. In: Bradburn, N. M., SUDMAN, S., editors. Improving interview method and questionnaire design. *San Francisco, CA: Jossey-Bass Publishers,* pp 26-50.

Briggs, G. G., Freeman, R. K. and Yaffe, S. J. (editors). 2008. Drugs in pregnancy and lactation: a reference guide to foetal and neonatal risk. 8th edition. *Baltimore: Williams & Wilkins.*

Broussard, C. S., Louik, C., Honein, M. A., Mitchell, A. A. and the National Birth Defects Prevention Study. 2010. Herbal use before and during pregnancy. *Am J Obstet Gynecol,* 202, 443.e1-6.

Brown, S. L. and Morley, A. M. 2007. Risk perception, fuzzy representations and comparative optimism. *British Journal of Psychology,* 98, 575-587.

Bryant, H. E., Visser, N. and Love, E. J. 1989. Records, recall loss, and recall bias in pregnancy: a comparison of interview and medical records data of pregnant and postnatal women. *Am J Public Health,* 79, 78-80.

Buchi, K. F., Varner, M. W., and Chase, R. A. 1993. The prevalence of substance abuse among pregnant women in Utah. *Obstet Gynecol,* 81, 239-242.

Buitendijk, S. and Bracken, M. B. 1991. Medication in early pregnancy: prevalence of use and relationship to maternal characteristics. *Am J Obstet Gynecol,* 165, 33-40.

Burd, L., Martsolf, J., Klug, M. G., O'Connor E. and Peterson M. 2003. Prenatal alcohol exposure assessment: multiple embedded measures in a prenatal questionnaire. *Neurotoxicology and Teratology,* 25, 675-679.

Butters, L. and Howie, C. A. 1990. Awareness among pregnant women of the effect on the fetus of commonly used drugs. *Midwifery,* 6, 146-154.

Cartwright, A. 1988. Interviews or postal questionnaires? Comparisons of data about women's experiences with maternity services. *Milbank Q,* 66, 172-189.

Centres for Disease Control and Prevention. 2004. Program operations guidelines for STD prevention: community and individual behavior change interventions.

C.G.D.U.P. (Collaborative Group on Drug Use in Pregnancy). 1992.

Medication during pregnancy: an intercontinental cooperative study. *Int J Gynaecol Obstet,* 39**,** 185-196.

Chaaya, M., Jabbour, S., El-Roueiheb, Z. and Chemaitelly, H. 2004. Knowledge, attitudes, and practices of argileh (water pipe or hubble-bubble) and cigarette smoking among pregnant women in Lebanon. *Addict Behav,* 29**,** 1821-1831.

Chang, G., Orav, E. J., Jones, J. A., Buynitsky, T., Gonzalez, S. and Wilkins-Haug, L. 2011. Self-reported alcohol and drug use in pregnant young women: A pilot study of prevalence and associated factors. *J Addict Med,* 5 (3), 221-226.

Chang, G., Mcnamara, T. K., Orav, E. J. and Wilkins-Haug, L. 2006. Alcohol use by pregnant women: partners, knowledge, and other predictors. *J Stud Alcohol,* 67**,** 245-251.

Chasnoff, I. J., Mcgourty, R. F., Bailey, G. W., Hutchins, E., Lightfoot, S. O., Pawson, L. L., Fahey, C., May, B., Brodie, P., Mcculley, L. And Campbell, J. 2005. The 4P's Plus screen for substance use in pregnancy: clinical application and outcomes. *J Perinatol,* 25**,** 368-374.

Chasnoff, I. J., Landress, H. J. And Barrett, M. E. 1990. The prevalence of illicit drug or alcohol use during pregnancy and discrepancies in mandatory reporting in pinellas county, Florida. *N Engl J Med,* 322, 1202-1206.

Checa, M. A., Peiro, R., Pascual, J. And Carreras, R. 2005. Drug intake behaviour of immigrants during pregnancy. *Eur J Obstet Gynecol Reprod Biol,* 121, 38-45.

Chomba, E., Tshefu, A., Onyamboko, M., Kaseba-Sata, C., Moore, J., Mcclure, E. M., Moss, N., Goco, N., Bloch, M. and Goldenberg, R. L. 2010. Tobacco use and secondhand smoke exposure during pregnancy in two African countries: Zambia and the Democratic Republic of the Congo. *Acta Obstet Gynecol Scand,* 89**,** 531-539.

Chuang, C. H., Chang, P. J., Hsieh, W. S., Tsai, Y. J., Lin, S. J. And Chen, P. C. 2009. Chinese herbal medicine use in Taiwan during pregnancy and the postpartum period: a population-based cohort study. *Int J Nurs Stud,* 46**,** 787-795.

Chuang, C. H., Doyle, P., Wang, J. D., Chang, P. J., Lai, J. N. and Chen, P. C. 2006. Herbal medicines used during the first trimester and major congenital malformations: an analysis of data from a pregnancy cohort study. *Drug Saf,* 29**,** 537-548.

Chuang, C. H., Hsieh, W. S., Guo, Y. L., Tsai, Y. J., Chang, P. J., Lin, S. J. and Chen, P. C. 2007. Chinese herbal medicines used in pregnancy: a population-based survey in Taiwan. *Pharmacoepidemiol Drug Saf,* 16**,** 464-468.

Cleary, B. J., Butt, H., Strawbridge, J. D., Gallagher, P. J., Fahey, T. And Murphy, D. J. 2010. Medication use in early pregnancy-prevalence and determinants of use in a prospective cohort of women. *Pharmacoepidemiol Drug Saf,* 19**,** 408-417.

Coles, C. 1994. Critical periods for prenatal alcohol exposure: Evidence from animal and human studies. *Alcohol Health & Research World,* 18 (1), 22-29.

Conner, M. 2010. Cognitive determinants of health behavior. Handbook of behavioral medicine methods and applications, Steptoe, A. (editor), *XXIV,* p. 1073.

Conner, M. and Norman, P. 1996. Predicting Health Behavior. Search and Practice with Social Cognition Models. *Open University Press: Ballmore: Buckingham.*

Conover, E. A. 2003. Herbal agents and over-the-counter medications in pregnancy. *Best Pract Res Clin Endocrinol Metabolism,* 17, 237-251.

Correy, J. F., Newman, N. M., Collins, J. A., Burrows, E. A., Burrows, R. F. and Curran, J. T. 1991. Use of prescription drugs in the first trimester and congenital malformations. *Aust N Z J Obstet Gynaecol,* 31**,** 340-344.

Coulter, I. and Willis, E. 2004. The rise and rise of complementary and alternative medicine: a sociological perspective. *Medical Journal of Australia,* 180, 587-589.

Crespin, S., Bourrel, R., Hurault-Delarue, C., Lapeyre-Mestre, M., Montastruc, J. and Damase-Michel, C. 2011. Drug prescribing before and during pregnancy in South West France: a retrolective study. *Drug Saf,* 34 (7), 595-604.

Creswell, J. W. 2007. Qualitative inquiry and research design: Choosing among five approaches. 2nd edition, *Thousand Oaks, CA: Sage.*

Cuzzolin, L., Francini-Pesenti, F., Verlato, G., Joppi, M., Baldelli, P. and Benoni, G. 2010. Use of herbal products among 392 Italian pregnant women: focus on pregnancy outcome. *Pharmacoepidemiol Drug Saf,* 19**,** 1151-1158.

Da Silva Dal Pizzol, T., Schuler-Faccini, L., Mengue, S. S. and Fischer, M. I. 2009. Dipyrone use during pregnancy and adverse perinatal events. *Arch Gynecol Obstet,* 279**,** 293-297.

Dal Pizzol TDA, S., Sanseverino, M. T. and Mengue, S. S. 2008. Exposure to misoprostol and hormones during pregnancy and risk of congenital anomalies. *Cad Saude Publica,* 24**,** 1447-1453.

Daly, S. F., Kiely, J., Clarke, T. A. and Matthews, T. G. 1992. Alcohol and cigarette use in a pregnant Irish population. *Ir Med J,* 85**,** 156-157.

Das, B. P., Joshi, M. and Pant, C. R. 2006. An overview of over-the-counter drugs in pregnancy and lactation. *Kathmandu University Medical Journal,* 4, 545-551.

Davis, D. B. 2010. Drugs in pregnancy – the issues for 2010. *J Popul Ther Clin Pharmacol,* 17, e331-e335.

Davis, R. L. 2010. Medication exposure in pregnancy risk evaluation program (MEPREP). *J Popul Ther Clin Pharmacol,* 17, e336-e340.

Daw, J. R., Mintzes, B., Law, M. R., Hanley, G. E. and Morgan, S. G. 2012. Prescription drug use in pregnancy: A retrospective, population-based study in British Columbia, Canada (2001-2006). *Clinical Therapeutics,* 34 (1), 239-249.

Day, N. L. and Richardson, G. A. 1991. Prenatal marijuana use: epidemiology, methodologic issues, and infant outcome. *Clin Perinatol,* 18, 77-91.

De Santis, M., De Luca, C., Quattrocchi, T., Visconti, D., Cesari, E., Mappa, I., Nobili, E., Spagnuolo, T. and Caruso, A. 2010. Use of the internet by women seeking information about potentially teratogenic agents. *Eur J Obstet Gynecol Reprod Biol,* 151 (2), 154-157.

De Santis, M., Straface, G., Carducci, B., Cavaliere, A. F., De Santis, L., Lucchese, A., Merola, A. M. and Caruso, A. 2004. Risk of drug-induced congenital defects. *Eur J Obstet Gynecol Reprod Biol,* 117, 10-19.

Dines, A., Ashworth, C., Edwards, N., Volans, G., Bewley, S. and Seed, P. T. 2005. A study to determine the use of medicines and drugs of abuse in high-risk early pregnancy. *Eur J Obstet Gynecol Reprod Biol,* 119, 129.

Donati, S., Baglio, G., Spinelli, A. and Grandolfo, M. E. 2000. Drug use in pregnancy among Italian women. *Eur J Clin Pharmacol,* 56, 323-328.

Dow-clarke, R. A. 1994. Healthy behaviours of pregnant women in Fort McMurray, Alberta. *Canadian Journal of Public Health,* 85, 33-36.

Dugoua, J. 2010. Herbal medicines and pregnancy. *J Popul Ther Clin Pharmacol,* 17, e370-378.

Durisova, A. and Magulova, L. 2004. Drug use--problem in pregnancy. *Bratisl Lek Listy,* 105**,** 123-124.

Easthope, G. 1993. The response of orthodox medicine to the challenge of alternative medicine in Australia. *ANZ J Sociol,* 29, 289-301.

Ebrahim, S. H. and Gfroerer, J. 2003. Pregnancy-related substance use in the United States during 1996-1998. *Obstet Gynecol,* 101**,** 374-379.

Egen-Lappe, V. and Hasford, J. 2004. Drug prescription in pregnancy: analysis of a large statutory sickness fund population. *Eur J Clin Pharmacol,* 60, 659-666.

Einarson, A. 2007. The way women perceive teratogenic risk: how it can influence decision making during pregnancy regarding drug use or abortion of a wanted pregnancy. In: Koren, G. (editor). Medication safety in pregnancy and breastfeeding. *New York: McGraw-Hill,* pp 309-312.

Engeland, A., Bramness, J. G., Daltveit, A. K., Ronning, M., Skurtveit, S. and Furu, K. 2008. Prescription drug use among fathers and mothers before and during pregnancy. A population-based cohort study of 106,000 pregnancies in Norway 2004-2006. *Br J Clin Pharmacol,* 65**,** 653-660.

Fakeye, T. O., Adisa, R. and Musa, I. E. 2009. Attitude and use of herbal medicines among pregnant women in Nigeria. *BMC Complement Altern Med,* 9**,** 53.

Falcon, M., Valero, F., Pellegrini, M., Rotolo, M. C., Scaravelli, G., Joya, J., Vall, O., Garcia Algar, O., Luna, A. and Pichini, S. 2010. Exposure to psychoactive substances in women who request voluntary termination of pregnancy assessed by serum and hair testing. *Forensic Sci Int,* 196**,** 22-26.

Fergusson, D. M., Horwood, L. J. and Northstone, K. 2002. Maternal use of cannabis and pregnancy outcome. *BJOG,* 109**,** 21-27.

Forfar, J. O. and Nelson, M. M. 1973. Epidemiology of drugs taken by pregnant women: drugs that may affect the fetus adversely. *Clin Pharmacol Ther,* 14**,** 632-642.

Forster, D. A., Denning, A., Wills, G., Bolger, M. and Mccarthy, E. 2006. Herbal medicine use during pregnancy in a group of Australian women. *BMC Pregnancy Childbirth,* 6**,** 21.

Frank, D. A., Zuckerman, B. S., Amaro, H., Aboagye, K., Bauchner, H., Cabral, H., Fried, L., Hingson, R., Kayne, H., Levenson, S. M., Parker, S., Reece, H. and Vinci, R. 1988. Cocaine use during pregnancy: prevalence and correlates. *Pediatrics,* 82**,** 888-895.

Frederiksen, M. C. 2001. Physiologic changes in pregnancy and their effect on drug disposition. *Semin Perinatol,* 25, 120-123.

Frey, J. H. 1989. Survey research by telephone. 2nd edition. *Newbury Park, CA: Sage Publications.*

Friguls, B. Joya, X., Garcia-Serra, J., Gomez-Culebras, M., Pichini, S., Martinez, S., Vall, O. and Garcia-Algar, O. 2012. Assessment of exposure to drugs of abuse during pregnancy by hair analysis in a Mediterranean island. *Addiction,* 107, 1471-1479.

Gaffney, L. and Smith, C. 2004. The views of pregnant women towards the use of complementary therapies and medicines. *Birth Issues,* 13, 43-50.

Gagne, J. J., Maio, V., Berghella, V., Louis, D. Z. and Gonnella, J. S. 2008. Prescription drug use during pregnancy: a population-based study in Regione Emilia-Romagna, Italy. *Eur J Clin Pharmacol,* 64**,** 1125-1132.

Garcia-Algar, O., Kulaga, V., Gareri, J., Koren, G., Vall, O., Zuccaro, P., Pacifici, R. and Pichini, S. 2008. Alarming prevalence of foetal alcohol exposure in a mediterranean city. Ther Drug Monit, 30, 249-254.

Garcia-Bournissen, F., Rokach, B., Karaskov, T. and Koren, G. 2007. Methamphetamine detection in maternal and neonatal hair: implications for fetal safety. *Arch Dis Child Fetal Neonatal Ed,* 92**,** F351-355.

Garcias, G. D. and Schuler-Faccini, L. 2004. The beliefs of mothers in southern Brazil regarding risk-factors associated with congenital abnormalities. *Genetics and Molecular Biology,* 27, 147-153.

Gardiner, P., Jarrett, K., Filippelli, A., Pecci, C., Mauch, M. and Jack, B. 2013. Herb use, vitamin use, and diet in low-income, postpartum women. *J Midwifery Women's Health,* 58, 150-157.

Gharoro, E. P. and Igbafe, A. A. 2000. Pattern of drug use amongst antenatal patients in Benin City, Nigeria. *Med Sci Monit,* 6**,** 84-87.

Gilchrist, D., Woods, B., Binns, C. W., Scott, J. A., Gracey, M. and Smith, H. 2004. Aboriginal mothers, breastfeeding and smoking. *Aust N Z J Public Health,* 28**,** 225-228.

Gilchrist, L. D., Hussey, J. M., Gillmore, M. R., Lohr, M. J. and Morrison, D. M. 1996. Drug use among adolescent mothers: prepregnancy to 18 months postpartum. *J Adolesc Health,* 19**,** 337-344.

Glanz, K., Rimer, B. K. and Lewis, F. M. (editors) 2002. Health behavior and Health education, 3rd edition. *San Francisco: Jossey Bass*.

Glover, D. D., Amonkar, M., Rybeck, B. F., and Tracy, T. S. 2003. Prescription, over-the-counter and herbal medicine use in a rural, obstetric population. *Am J Obstet Gynecol,* 188, 1039-1045.

Golden, N. L., Kuhnert, B. R., Sokol, R. J., Martier, S. and Bagby, B. S. 1984. Phencyclidine use during pregnancy. *Am J Obstet Gynecol,* 148**,** 254-259.

Graham, M. E. 2002. Health beliefs and self breast examination in black women. *Journal of Cultural Diversity,* 9 (2), 49-54.

Gray, T. R., Lagasse, L. L., Smith, L. M., Derauf, C., Grant, P., Shah, R., Arria, A. M., Della Grotta, S. A., Strauss, A., Haning, W. F., Lester, B. M. and Huestis, M. A. 2009. Identification of prenatal amphetamines exposure by maternal interview and meconium toxicology in the Infant Development, Environment and Lifestyle (IDEAL) study. *Ther Drug Monit,* 31**,** 769-775.

Griffiths, A. N., Woolley, J. L., Avasarala, S., Roy, M. and Wiener, J. J. 2005. Survey of antenatal women's knowledge of maternal and fetal risks of tobacco smoking and acceptability of nicotine replacement products in pregnancy. *J Obstet Gynaecol,* 25**,** 432-434.

Hall, H. R. and Jolly, K. 2013. Women's use of complementary and alternative medicines during pregnancy: a cross-sectional study. *Midwifery,* Epub ahead of print.

Hansen, W. F., Peacock, A. E. and Yankowitz, J. 2002. Safe prescribing practices in pregnancy and lactation. *J Midwifery Womens Health,* 47, 409-421.

Hansen, W. and Yankowitz, J. 2002. Pharmacologic therapy for medical disorders during pregnancy. *Clin Obstet Gynaecol,* 45, 136-152.

Hardy, J. R., Leaderer, B. P., Holford, T. R., Hall, G. C. and Bracken, M. B. 2006. Safety of medications prescribed before and during early pregnancy in a cohort of 81 975 mothers from the UK General Practice Research Database. *Pharmacoepidemiol Drug Saf,* 15, 555-564.

Harrison, P. A. and Sidebottom, A. C. 2009. Alcohol and drug use before and during pregnancy: an examination of use patterns and predictors of cessation. *Matern Child Health J,* 13**,** 386-394.

Haslam, C. and Lawrence, W. 2004. Health-related behaviour and beliefs of pregnant smokers. *Health Psychology,* 23, 486-491.

Haslam, C., Lawrence, W. and Haefali, K. 2003. Intention to breastfeed and other important health-related behaviour and beliefs during pregnancy. *Family Practice,* 20, 528-530.

Havens, J. R., Simmons, L. A., Shannon, L. M. and Hansen, W. F. 2009. Factors associated with substance use during pregnancy: results from a national sample. *Drug Alcohol Depend,* 99**,** 89-95.

Hayatbakhsh, M. R., Flenady, V. J., Gibbons, K. S., Kingsbury, A. M., Hurrion, E., Mamun, A. A. and Najman, J. M. 2012. Birth outcomes associated with cannabis use before and during pregnancy. *Pediatric Research,* 71 (2), 215-219.

Hayes, M. J., Brown, E., Hofmaster, P. A., Davare, A. A., Parker, K. G. and Raczek, J. A. 2002. Prenatal alcohol intake in a rural, caucasian clinic. *Fam Med,* 34**,** 120-125.

Headley, J., Northstone, K., Simmons, H. and Golding, J. 2004. Medication use during pregnancy: data from the Avon Longitudinal Study of Parents and Children. *Eur J Clin Pharmacol,* 60**,** 355-361.

Heaman, M., Gupton, A. and Gregory, D. 2004. Factors influencing pregnant women's perceptions of risk. *MCN, American Journal of Maternal Child Nursing,* 29 (2), 111-116.

Heikkila, A. M., Erkkola, R. U. and Nummi, S. E. 1994. Use of medication during pregnancy--a prospective cohort study on use and policy of prescribing. *Ann Chir Gynaecol Suppl,* 208**,** 80-83.
Henry, A. and Crowther C. 2000. Patterns of medication use during and prior to pregnancy: the MAP study. *Aust N Z J Obstet Gynaecol,* 40, 165-172.

Hennekens, C. H. and Buring, J. E. 1987. Epidemiology in Medicine. *Lippincott Williams and Wilkins*.

Hepner, D. L., Harnett, M., Segal, S., Camann, W., Bader, A. M. and Tsen, L. C. 2002. Herbal medicine use in parturients. *Anesth Analg,* 94**,** 690-693.

Hernandez-Diaz, S. 2006. Prescription of medications during pregnancy: accidents, compromises, and uncertainties. *Pharmacoepidemiol Drug Saf,* 15, 613-617.

Hogg, M. A. and Vaughan, G. M. 2005. Social Psychology. 4th edition. *USA: Prentice Hall,* p 150.

Hingson, R., Zuckerman, B., Amaro, H., Frank, D. A., Kayne, H., Sorenson, J. R., Mitchell, J., Parker, S., Morelock, S. and Timperi, R. 1986. Maternal marijuana use and neonatal outcome: uncertainty posed by self-reports. *Am J Public Health,* 76, 667-669.

Hollyer, T., Boon, H., Georgousis, A., Smith, M. and Einarson, A. 2002. The use of CAM by women suffering from nausea and vomiting during pregnancy. *BMC Complement Altern Med,* 2**,** 5.

Holst, L., Wright, D., Haavik, S. and Nordeng, H. 2009a. The use and the user of herbal remedies during pregnancy. *J Altern Complement Med,* 15**,** 787-792.

Holst, L., Wright, D., Nordeng, H. and Haavik, S. 2009b. Use of herbal preparations during pregnancy: focus group discussion among expectant mothers attending a hospital antenatal clinic in Norwich, UK. *Complement Ther Clin Pract,* 15**,** 225-229.

Holst, L., Nordeng, H. and Haavik, S. 2008. Use of herbal drugs during early pregnancy in relation to maternal characteristics and pregnancy outcome. *Pharmacoepidemiol Drug Saf,* 17, 151-159.

Irl, C. and Hasford, J. 2000. Assessing safety of drugs in pregnancy- the role of prospective cohort studies. *Drug Safety,* 22, 169-177.

Irl, C. and Hasford, J. 1997. The PEGASUS project--a prospective cohort study for the investigation of drug use in pregnancy. PEGASUS Study Group. *Int J Clin Pharmacol Ther,* 35**,** 572-576.

Irvine, L., Flynn, R. W., Libby, G., Crombie, I. K. and Evans, J. M. 2010. Drugs dispensed in primary care during pregnancy: a record-linkage analysis in Tayside, Scotland. *Drug Saf,* 33**,** 593-604.

Janz, N. K. and Becker, M. H. 1984. The Health Belief Model: A decade later. *Health Education Quarterly,* 11 (1), 1-47.

Jimenez, E., Bosch, F., Lopez, A., Costa, J., Cos, R. and Banos, J. E. 1998. Patterns of regular drug use in Spanish childbearing women: changes elicited by pregnancy. *Eur J Clin Pharmacol,* 54**,** 645-651.

Jobe, A. H. 2010. Statistically twins. *The Journal of Pediatrics,* 156 (2), A1.

Jones, E. J., Roche, C. C. and Appel, S. J. 2009. A review of the health beliefs and lifestyle behaviors of women with previous gestational diabetes. *JOGNN,* 38, 516-526.

Jones, P. K., Jones, S. L. and Katz, J. 1987. Improving compliance for asthma patients visiting the emergency department using a health belief model intervention. *Journal of Asthma,* 24, 199-206.

Jones, S. C. and Telenta, J. 2012. What influences Australian women to not drink alcohol during pregnancy? *Australian Journal of Primary Health,* 18, 68-73.

Joya, X., Gomez-Culebras, M., Callejon, A., Friguls, B., Puig, C., Ortigosa, S., Morini, L., Garcia-Algar, O. and Vall, O. 2012. Cocaine use during pregnancy assessed by hair analysis in a Canary islands cohort. *BMC Pregnancy and Childbirth,* 12, 2.

Kalder, M., Knoblauch, K., Hrgovic, I. and Munstedt, K. 2010. Use of complementary and alternative medicine during pregnancy and delivery. *Arch Gynecol Obstet*.

Kaptein, A. A., Van Korlaar, I. M., Cameron, L. D., Vossen, C. Y., Van Der Meer, F. J. and Rosendaal, F. R. 2007. Using the common-sense model to predict risk perception and disease-related worry in individuals at increased risk for venous thrombosis. *Health Psychology,* 26, 807-812.

Karcaaltincaba, D., Kandemir, O., Yalvac, S., Guven, E. S., Yildirim, B. A. and Haberal, A. 2009. Cigarette smoking and pregnancy: results of a survey at a Turkish women's hospital in 1,020 patients. *J Obstet Gynaecol,* 29**,** 480-486.

Kaskutas, L. A. 2000. Understanding drinking during pregnancy among urban American Indians and African Americans: health messages, risk beliefs, and how we measure consumption. *Alcohol Clin Exp Res,* 24**,** 1241-1250.

Kebede, B., Gedif, T. and Getachew, A. 2009. Assessment of drug use among pregnant women in Addis Ababa, Ethiopia. *Pharmacoepidemiol Drug Saf,* 18**,** 462-468.

Kelsey, J. L., Evans, A. S. and Thompson, W.D. 1996. Measurement: Questionnaires. In *Methods in Observational Epidemiology,* Kelsey J. L., Evans A. S., Thompson W. D. (editors). *Oxford University Press: Oxford;* pp 364-390.

Kesmodel, U. and Kesmodel, P. S. 2002. Drinking during pregnancy: attitudes and knowledge among pregnant Danish women, 1998. *Alcohol Clin Exp Res,* 26, 1553-1560.

Khadivzadeh, T. and Ghabel, M. 2012. Complementary and alternative medicine use in pregnancy in Mashhad, Iran, 2007-8. *Iranian Journal of Nursing and Midwifery Research,* 17 (4), 263-269.

Kim, O. and Park, K. 2011. Prenatal alcohol consumption and knowledge about alcohol consumption and fetal alcohol syndrome in Korean women. *Nurs Health Sci,* 13**,** 303-308.

Kokotailo, P. K., Adger, H., Jr., Duggan, A. K., Repke, J. and Joffe, A. 1992. Cigarette, alcohol, and other drug use by school-age pregnant adolescents: prevalence, detection, and associated risk factors. *Pediatrics,* 90**,** 328-334.

Kokotailo, P. K., Langhough, R. E., Cox, N. S., Davidson, S. R. and Fleming, M. F. 1994. Cigarette, alcohol and other drug use among small city pregnant adolescents. *J Adolesc Health,* 15**,** 366-373.

Koren, G. 2002. Ethical framework for observational studies of medicinal drug exposure in pregnancy. *Teratology,* 65, 191-195.

Koren, G., Chan, D., Klein, J. and Karaskov, T. 2002. Estimation of fetal exposure to drugs of abuse, environmental tobacco smoke, and ethanol. *Ther Drug Monit,* 24, 23-25.

Koren, G., Pastuszak A. and Ito, S. 1998. Drugs in pregnancy. *N Engl J Med,* 338, 1128-1137.

Koren, G. and Pastuszak, A. 1990. Prevention of unnecessary pregnancy terminations by counselling women on drug, chemical, and radiation exposure during the first trimester. *Teratology,* 41, 657-661.

Koren, G., Bologa, M., Long, D., Feldman, Y. and Shear, N. H. 1989. Perception of teratogenic risk by pregnant women exposed to drugs and chemicals during the first trimester. *Am J Obstet Gynecol,* 160, 1190-1194.

Kormendi, E. and Noordhoek, J. 1989. Data quality and telephone interviews. *Copenhagen, Denmark: Danmarks Statistik.*

Kraemer, K. 1997. Placental transfer of drugs. *Neonatal Network,* 16, 65-67.

Kralikova, E., Bajerova, J., Raslova, N., Rames, J. and Himmerova, V. 2005. Smoking and pregnancy: prevalence, knowledge, anthropometry, risk communication. *Prague Med Rep,* 106**,** 195-200.

Kratz, L. M. and Vaughan, E. L. 2012. Mental health problems, legal involvement, and smoking during pregnancy. *Substance Use & Misuse,* 47, 718-725.

Krueger, R. 1994. Focus groups. A practical guide for applied research. *London: Sage Publications.*

Kuczkowski, K. M. 2007. The effects of drug abuse on pregnancy. *Curr Opin Obstet Gynecol,* 19, 578-585.

Kuczkowski, K. M. 2003a. Anesthetic implications of drug abuse in pregnancy. *J Clin Anesth,* 15, 382-394.

Kuczkowski, K. M. 2003b. Labor analgesia for the drug abusing parturient: is there cause for concern? *Obstet Gynecol Surv,* 58, 599-608.

Kulaga, S., Zagarzadeh, A. and Berard, A. 2009. Prescriptions filled during pregnancy for drugs with the potential of foetal harm. *BJOG,* 116, 1788-1795.

Lacroix, I., Hurault, C., Sarramon, M. F., Guitard, C., Berrebi, A., Grau, M., Albouy-Cossard, C., Bourrel, R., Elefant, E., Montastruc, J. L. and Damase-Michel, C. 2009. Prescription of drugs during pregnancy: a study using EFEMERIS, the new French database. *Eur J Clin Pharmacol,* 65**,** 839-846.

Lacroix, I., Damase-Michel, C., Lapeyre-Mestre M. and Montastruc, J. L. 2000. Prescription of drugs during pregnancy in France. *Lancet,* 356, 1735-1736.

Lagan, B., Sinclair, M. and Kernohan, W. G. 2006. Pregnant women's use of the internet: a review of published and unpublished evidence. *Evidence Based Midwifery,* 4 (1), 17-23.

Lagoy, C. T., Joshi, N., Cragan, J. D. and Rasmussen, S. A. 2005. Medication use during pregnancy and lactation: an urgent call for public health action. *Journal of Women's Health,* 14, 104-109.

Lapi, F., Vannacci, A., Moschini, M., Cipollini, F., Morsuillo, M., Gallo, E., Banchelli, G., Cecchi, E., Pirro, M. D., Giovannini, M. G., Cariglia, M. T., Gori, L., Firenzuoli, F. and Mugelli, A. 2008. Use, Attitudes and Knowledge of Complementary and Alternative Drugs (CADs) Among Pregnant Women: a Preliminary Survey in Tuscany. *Evid Based Complement Alternat Med*.

Larivaara, P., Hartikainen, A. L. and Rantakallio, P. 1996. Use of psychotropic drugs and pregnancy outcome. *J Clin Epidemiol,* 49**,** 1309-1313.

Lawson, E. J. 1994. The role of smoking in the lives of low-income pregnant adolescents: a field study. *Adolescence,* 29, 61.

Lelong, N., Kaminski, M., Chwalow, J., Bean, K. and Subtil, D. 1995. Attitudes and behavior of pregnant women and health professionals towards alcohol and tobacco consumption. *Patient Educ Couns,* 25**,** 39-49.

Lendoiro, E., Gonzalez-Colmenero, E., Concheiro-Guisan, A., De Castro, A., Cruz, A., Lopez-Rivadulla, M. and Concheiro, M. 2013. Maternal hair analysis for the detection of illicit drugs, medicines, and alcohol exposure during pregnancy. *Ther Drug Monit,* 35 (3), 296-304.

Leppo, A. 2012. "Subutex is safe": Perceptions of risk in using illicit drugs during pregnancy. *International Journal of Drug Policy,* 23, 365-373.

Lester, B. M., Elsohly, M., Wright, L. L., Smeriglio, V. L., Verter, J., Bauer, C. R., Shankaran, S., Bada, H. S., Walls, H. H., Huestis, M. A., Finnegan, L. P. and Maza, P. L. 2001. The Maternal Lifestyle Study: drug use by meconium toxicology and maternal self-report. *Pediatrics,* 107**,** 309-317.

Lester, S. 1999. An introduction to phenomenological research. *Taunton UK, Stan Lester Developments.* Available at: http://www.sld.demon.co.uk/resmethy.pdf (Last accessed 2 November 2014)

Levin, K. A. 2003. Study design IV. Cohort studies. *Evidence-Based Dentistry,* 7, 51-52.

Lewis, J. L. and Sheppard, S. R. J. 2006. Culture and communication: can landscape visualisation improve forest management consultation with indigenous communities? *Landscape and Urban Planning,* 77, 291-313.

Li, D. K., Liu, L. and Odouli, R. 2003. Exposure to non-steroidal anti-inflammatory drugs during pregnancy and risk of miscarriage: population based cohort study. *BMJ,* 327**,** 368.

Loebstein, R., Lalkin, A. and Koren, G. 1997. Pharmacokinetic changes during pregnancy and their clinical relevance. *Clin Pharmacokinet,* 33, 328-343.

Lozano, J., Garcia-Algar, O., Marchei, E., Vall, O., Monleon, T., Di Giovannandrea, R. and Pichini, S. 2007. Prevalence of gestational exposure to cannabis in a mediterranean city by meconium analysis. *Acta Paediatrica,* 96, 1734-1737.

Lyberg, L. E. and Kasprzyk, D. 1991. Data collection methods and measurement error: an overview. In: BIEMER, P. B., SUDMAN, S., GROVES, R. M., LYBERG, L. E. and MATHIOWETZ, N. A. (editors). Measurement errors in surveys. *New York, NY: John Wiley & Sons,* Inc, pp 237-257.

Maats, F. H. and Crowther, C. A. 2002. Patterns of vitamin, mineral and herbal supplement use prior to and during pregnancy. *Aust N Z J Obstet Gynaecol,* 42, 494-496.

Mabina, M. H., Moodley, J. and Pitsoe, S. B. 1997. The use of traditional herbal medication during pregnancy. *Trop Doct,* 27**,** 84-86.

Malan, D. F. and Neuba, D. FR. 2011. Traditional practices and medicinal plants use during pregnancy by Anyi-Ndenye women (Eastern Cote d'Ivoire). *Afr J Reprod Health,* 15 (1), 85-93.

Mallard, S. R., Connor, J. L. and Houghton, L. A. 2013. Maternal factors associated with heavy periconceptional alcohol intake and drinking following

pregnancy recognition: A post-partum survey of New Zealand women. *Drug Alcohol Rev,* 32, 389-397.

Malterud, K. 2001. Qualitative research: standards, challenges, and guidelines. *Lancet,* 358, 483-488.

Marcus, S. M. and Flynn, H. A. 2008. Depression, antidepressant medication, and functioning outcomes among pregnant women. *Int J Gynaecol Obstet,* 100**,** 248-251.

Martinez Crespo, J. M., Antolin, E., Comas, C., Coll, O., Marques, J. M., Gual, A. and Fortuny, A. 1994. The prevalence of cocaine abuse during pregnancy in Barcelona. *Eur J Obstet Gynecol Reprod Biol,* 56**,** 165-167.

Mashayekhi, S. O., Dilmaghanizadeh, M., Fardiazar, Z., Bamdad-Moghadam, R. and Ghandforoush-Sattari, F. 2009. Study of awareness among pregnant women of the effects of drugs on the fetus and mother in Iran. *Health Policy,* 91**,** 89-93.

Massele, A. Y., Mpundu, M. N. and Hamudu, N. A. 1997. Utilisation of antimalarial drugs by pregnant women attending the antenatal clinic at Muhimbili Medical Centre, Dar es Salaam. *East Afr Med J,* 74**,** 28-30.

McLay, J. S., Stewart, D., George, J., Rore, C. and Heys, S. D. 2012. Complementary and alternative medicines use by Scottish women with breast cancer. What, why and the potential for drug interactions? *Eur J Clin Pharmacol,* 68, 811-819.

Mehta, N. and Larson, L. 2011. Pharmacotherapy in pregnancy and lactation. *Clin Chest Med,* 32, 43-52.

Milla, G. R., Flores, A. L., Umana, E., Mayes, I. and Rosenthal, J. 2007. Postpartum women in the Honduran health system: folic acid knowledge, attitudes, and practices. *Rev Panam Salud Publica,* 22, 340-347.

Mitchell, A. A. 2003. Systematic identification of drugs that cause birth defects- A new opportunity. *N Engl J Med,* 349, 2556-2559.

Mitchell, A. A. 2000. Special considerations in studies of drug-induced birth defects. In: Strom B., editor. *Pharmacoepidemiology. Hoboken, N. J. John Wiley & Sons.*

Montano, D. E., Kasprzyk, D. and Taplin, S. H. 1997. The theory of reasoned action and theory of planned behaviour. In: Glanz, K., Lewis, F. M. and

Rimer, B. K. (editors), Health Behavior and Health Education: Theory, Research, and Practice, 2nd edition. *San Francisco, CA: Jossey-Bass, Inc,* 85-112.

Moussally, K., Oraichi, D. and Berard, A. 2009. Herbal products use during pregnancy: prevalence and predictors. *Pharmacoepidemiol Drug Saf,* 18**,** 454-461.

Moustakas, C. 1994. Phenomenological research methods. *Thousand Oaks, CA: Sage.*

Mureyi, D. D., Monera, T. G. and Maponga, C. C. 2012. Prevalence and patterns of prenatal use of traditional medicine among women at selected Harare clinics: a cross-sectional study. *BMC Complementary and Alternative Medicine,* 12, 164.

National Cancer Institute. 2003. Theory at a glance: A guide for health promotion practice. Washington, DC: U.S. Department of Health and Human Services.

National Centre For Complementary And Alternative
Medicine. 2013. What is complementary and alternative medicine?
Available at: http://nccam.nih.gov/health/whatiscam (Last accessed 18 March 2013).

Nelson, M. M. and Forfar, J. O. 1971. Associations between drugs administered during pregnancy and congenital abnormalities of the foetus. *BMJ,* 1, 523-527.

NICE (National Institute for Health and Clinical Excellence) guideline 2009. Medicines adherence: involving patients in decisions about prescribed medicines and supporting adherence. Available at: http://www.nice.org.uk/nicemedia/live/11766/43042/43042.pdf (Last accessed 28 February 2014).

Nordeng, H., Hansen, C., Garthus-Niegel, S. and Eberhard-Gran, M. 2012. Fear of childbirth, mental health, and medication use during pregnancy. *Arch Womens Ment Health,* 15, 203-209.

Nordeng, H., Bayne, K., Havnen, G. C. and Paulsen, B. S. 2011. Use of herbal drugs during pregnancy among 600 Norwegian women in relation to concurrent use of conventional drugs and pregnancy outcome. *Complementary Therapies in Clinical Practice,* 17, 147-151.

Nordeng, H., Koren, G. and Einarson, A. 2010a. Pregnant women's beliefs about medications--a study among 866 Norwegian women. *Ann Pharmacother,* 44**,** 1478-1484.

Nordeng, H., Ystrom, E. and Einarson, A. 2010b. Perception of risk regarding the use of medications and other exposures during pregnancy. *Eur J Clin Pharmacol,* 66, 207-214.

Nordeng, H. and Havnen, G. C. 2005. Impact of socio-demographic factors, knowledge and attitude on the use of herbal drugs in pregnancy. *Acta Obstet Gynecol Scand,* 84**,** 26-33.

Nordeng, H. and Havnen, G. C. 2004. Use of herbal drugs in pregnancy: a survey among 400 Norwegian women. *Pharmacoepidemiol Drug Saf,* 13**,** 371-380.

Nordeng, H., Eskild, A., Nesheim, B. I., Aursnes, I. and Jacobsen, G. 2001. Drug use during early pregnancy. The impact of maternal illness, outcome of prior pregnancies and socio-demographic factors. *Eur J Clin Pharmacol,* 57**,** 259-263.

Nutbeam, D. and Harris, E. 2004. Theory in a Nutshell: A practical guide to health promotion theories. *McGraw-Hill, Australia, Sydney*.

Nybo Andersen, A. and Olsen, J. 2002. Do interviewers' health beliefs and habits modify responses to sensitive questions? A study using data collected from pregnant women by means of computer-assisted telephone interviews. *American Journal of Epidemiology,* 155, 95-100.

Odalovic, M., Kovacevic, S. V., Ilic, K., Sabo, A. and Tasic, L. 2012. Drug use before and during pregnancy in Serbia. *Int J Clin Pharm,* 34, 719-727.

Olesen, C., Steffensen, F. H., Nielsen, G. L., De Jong-Van Den Berg, L., Olsen, J. and Sorensen, H. T. 1999. Drug use in first pregnancy and lactation: a population-based survey among Danish women. The EUROMAP group. *Eur J Clin Pharmacol,* 55**,** 139-144.

Olesen, C., Sondergaard, C., Thrane, N., Nielsen, G. L., De Jong-Van Den Berg, L. and Olsen, J. for the EuroMAP Group. 2001. Do pregnant women report use of dispensed medications? *Epidemiology,* 12, 497-501.

Olesen, C., Thrane, N., Henriksen, T. B., Ehrenstein, V. and Olsen, J. 2006. Associations between socio-economic factors and the use of prescription

medication during pregnancy: a population-based study among 19,874 Danish women. *Eur J Clin Pharmacol,* 62**,** 547-553.

Ong, C., Chan, L., Yung, P. and Leung, T. 2005. Use of traditional Chinese herbal medicine during pregnancy: a prospective survey. *Acta Obstetricia et Gynecologica Scandinavica,* 84, 699-700.

Opaneye, A. A. 1998. Traditional medicine in Nigeria and modern obstetric practice: need for cooperation. *Cent Afr J Med,* 44**,** 258-261.

Orji, R., Vassileva, J. and Mandryk, R. 2012. Towards an effective health interventions design: An extension of the health belief model. *Online Journal of Public Health Informatics,* 4 (3), e9.

Ostrea, E. M., Brady, M., Gause, S., Raymundo, A. L. and Stevens, M. 1992. Drug screening of newborns by meconium analysis: a large-scale, prospective, epidemiologic study. *Pediatrics,* 89, 107-113.

Passey, M. E., D'Este, C. A., Stirling, J. M. and Sanson-Fisher, R. W. 2012. Factors associated with antenatal smoking among Aboriginal and Torres Strait Islander women in two jurisdictions. *Drug Alcohol Rev,* 31, 608-616.

Peadon, E., Payne, J., Henley, N., D'Antoine, H., Bartu, A., O'Leary, C., Bower, C. and Elliot, E. J. 2010. Women's knowledge and attitudes regarding alcohol consumption in pregnancy: a national survey. *BMC Public Health,* 10, 510.

Pegues, D. A., Engelgau, M. M. and Woernle, C. H. 1994. Prevalence of illicit drugs detected in the urine of women of childbearing age in Alabama public health clinics. *Public Health Rep,* 109, 530-538.

Perham-Hester, K. A. and Gessner, B. D. 1997. Correlates of drinking during the third trimester of pregnancy in Alaska. *Matern Child Health J,* 1**,** 165-172.

Perry, C., Baranowski, T. and Parcel, G. 1990. How individuals, environments, and health interact: Social Learning Theory. In: Glanz, K., Lewis, F. M. and Rimer, B. K. (editors). Health Behavior and Health Education: Theory, Research, and Practice. San Francisco: Jossey-Bass, 161-186.

Pichini, S., Puig, C., Zuccaro, P., Marchei, E., Pellegrini, M., Murillo, J., Vall, O., Pacifici, R. and Garcia-Algar, O. 2005. Assessment of exposure to opiates and cocaine during pregnancy in a Mediterranean city: preliminary results of the "Meconium Project". *Forensic Sci Int,* 153**,** 59-65.

Pinn, G. and Pallett, L. 2002. Herbal medicine in pregnancy. *Complement Ther Nurs Midwifery,* 8**,** 77-80.

Pletsch, P. K. and Johnson, M. K. 1996. The cigarette smoking experience of pregnant Latinas in the United States. *Health Care for Women International,* 17, 549-562.

Polkinghorne, D. E. 1989. Phenomenological research methods. In: Valle, R. S. and Halling, S. (editors), Existential-phenomenological perspectives in psychology. *New York: Plenum,* 41-60.

Porter, R. S., editor. 2004. The merck manual's online medical library. *Whitehouse Station: Merck Research Lab.*

Rachidi, S., Awada, S., Al-Hajje, A., Bawab, W., Zein, S., Saleh, N. and Salameh, P. 2013. Risky substance exposure during pregnancy: a pilot study from Lebanese mothers. *Drug, Healthcare and Patient Safety,* 5, 123-131.

Raymond, N., Beer, C., Glazebrook, C. and Sayal, K. 2009. Pregnant women's attitudes towards alcohol consumption. *BMC Public Health,* 9**,** 175.

Redding, C. A., Rossi, J. S., Rossi, S. R., Velicer, W. F. and Prochaska, J. O. 2000. Health behaviour models. *The International Electronic Journal of Health Education,* 3, 180-193.

Reeves, S., Albert, M., Kuper, A. and Hodges, B. D. 2008. Why use theories in qualitative research? *BMJ,* 337, a949.

Refuerzo, J. S., Blackwell, S. C., Sokol, R. J., Lajeunesse, L., Firchau, K., Kruger, M. and Sorokin, Y. 2005. Use of over-the-counter medications and herbal remedies in pregnancy. *Am J Perinatol,* 22**,** 321-324.

Riley, E. H., Fuentes-Afflick, E., Jackson, R. A., Escobar, G. J., Brawarsky, P., Schreiber, M. and Haas, J. S. 2005. Correlates of prescription drug use during pregnancy. *J Womens Health (Larchmt),* 14**,** 401-409.

Rich, M. and Ginsburg, K. R. 1999. The reason and rhyme of qualitative research: why, when, and how to use qualitative methods in the study of adolescent health. *Journal of Adolescent Health,* 25, 371-378.

Ritchie, J. 2001. Not everything can be reduced to numbers. In: Berglund, C. A. (editor), Health Research. *Oxford University Press, Melbourne*.

Rosenblatt, D. 1998. Adherence in pregnancy. In: Myers, L.B., Midence, K., eds. Adherence to Treatment in Medical Conditions. *Harwood Academic Publishers, Amsterdam.*

Rosenstock, I. M., Stretcher, V. J. and Becker, M. H. 1988. Social learning theory and the Health Belief Model. *Health Education Quarterly,* 15 (2), 175-183.

Rosenstock, I. M. 1974. Historical origins of the health belief model. *Health Educ Monogr,* 2, 328-335.

Rubin, P. C., Craig, G. F., Gavin, K. and Sumner, D. 1986. Prospective survey of use of therapeutic drugs, alcohol, and cigarettes during pregnancy. *Br Med J (Clin Res Ed),* 292**,** 81-83.

Sachdeva, P., Patel, B. G. and Patel, B. K. 2009. Drug use in pregnancy; a point to ponder! *Indian J Pharm Sci,* 71, 1-7.

Santiago, S. E., Park, G. H and Huffman, K. J. 2013. Consumption habits of pregnant women and implications for developmental biology: a survey of predominantly Hispanic women in California. *Nutrition Journal,* 12, 91.

Sanz, E., Gomez-Lopez, T. and Martinez-Quintas, M. J. 2001. Perception of teratogenic risk of common medicines. *Eur J Obstet Gynecol Reprod Biol,* 95, 127-131.

Sawicki, E., Stewart, K., Wong, S., Leung, L., Paul, E. and George, J. 2011. Medication use for chronic health conditions by pregnant women attending an Australian maternity hospital. *Australian and New Zealand Journal of Obstetrics and Gynaecology,* 51, 333-338.

Schempf, A. H. 2007. Illicit drug use and neonatal outcomes: a critical review. *Obstet Gynecol Surv,* 62, 749-757.

Schempf, A. H. and Strobino, D. M. 2008. Illicit drug use and adverse birth outcomes: is it drugs or context? *J Urban Health,* 85**,** 858-873.

Scialli, A. R., Buelke-Sam, J. L., Chambers, C. D., Friedman, J. M., Kimmel, C. A., Polifka, J. E. and Tassinari, M. S. 2004. Communicating risks during pregnancy: a workshop on the use of data from animal developmental toxicity studies in pregnancy labels for drugs. *Birth Defects Res Part A Clin Mol Teratol,* 70, 7.

Seidler, J. 1974. On using informants: a technique for collecting quantitative data and controlling measurement error in organization analysis. American Sociological Review, 39, 816-831.

Senecky, Y., Weiss, N., Shalev, S. A., Peleg, D., Inbar, D., Chodick, G., Nachum, Z., Bar-Hamburger, R. and Shuper, A. 2011. Alcohol consumption during pregnancy among women in Israel. *J Popul Ther Clin Pharmacol,* 18**,** e261-e272.

Senn, M., Baiwog, F., Winmai, J., Mueller, I., Rogerson, S. and Senn, N. 2009. Betel nut chewing during pregnancy, Madang province, Papua New Guinea. *Drug Alcohol Depend,* 105**,** 126-131.

Sheeran, P. and Abraham, C. 1996. The health belief model. In: Conner, M. and Norman, P. (editors), Predicting Health Behaviour. *Buckingham: Open University Press.*

Shehata, H. A. and Nelson-Piercy, C. 2001. Drugs to avoid in pregnancy. *Best Pract Res Clin Obstet Gynaecol,* 15, 971-986.

Skouteris, H., Wertheim, E. H., Rallis, S., Paxton, S. J., Kelly, L. and Milgrom, J. 2008. Use of complementary and alternative medicines by a sample of Australian women during pregnancy. *Aust N Z J Obstet Gynaecol,* 48**,** 384-390.

Sorensan, M. K., Phillips, B. B. and Mutnick, A. H. 2004. Drug use in specific patient populations: pediatric, pregnant, geriatric. In: *Shargel L., Mutnick A., editors. Comprehensive Pharmacy Review. 5th ed. Philadelphia: Lippincott William Wilkins,* pp 673-682.

Splinter, M. Y., Sagraves, R., Nightengale, B. and Rayburn, W. F. 1997. Prenatal use of medications by women giving birth at a university hospital. *South Med J,* 90**,** 498-502.

Stephansson, O., Granath, F., Svensson, T., Haglund, B., Ekbom, A. and Kieler, H. 2011. Drug use during pregnancy in Sweden – assessed by the Prescribed Drug Register and the Medical Birth Register. *Clinical Epidemiology,* 3, 43-50.

Stewart, D. E. and Streiner, D. L. 1995. Cigarette smoking during pregnancy. *Can J Psychiatry,* 40**,** 603-607.

Stewart, D. E. and Streiner, D. L. 1994. Alcohol drinking in pregnancy. *Gen Hosp Psychiatry,* 16**,** 406-412.

Steyn, K., Yach, D., Stander, I. and Fourie, J. M. 1997. Smoking in urban pregnant women in South Africa. *S Afr Med J,* 87**,** 460-463.

Strauss, A. and Corbin, J. 1998. Basics of qualitative research: Grounded theory procedures and techniques. 2nd edition. *Newbury Park, CA: Sage.*

Stretcher, V. and Rosenstock, I. M. 1997. The Health Belief Model. In: Glanz, K., Lewis, F. M. and Rimer, B. K. (editors). Health behavior and Health education: Theory, Research and Practice, 2nd edition. *San Francisco: Jossey-Bass*.

Suresh, L. and Radfar, L. 2004. Pregnancy and lactation. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod,* 97, 672-682.

Teagle, S. E. and Brindis, C. D. 1998. Substance use among pregnant adolescents: a comparison of self-reported use and provider perception. *J Adolesc Health,* 22**,** 229-238.

Tiedje, L. B., Kingry, M. J. and Stommel, M. 1992. Patient attitudes concerning health behaviors during pregnancy: initial development of a questionnaire. *Health Educ Q,* 19 (4), 481-493.

Tillet, J., Kostich, L. M. and Vandevusse, L. 2003. Use of over-the-counter medications during pregnancy. *J Perinat Neonat Nurs,* 17, 3-18.

Tinsley, B. J. 1993. The significance of women's pregnancy related locus of control beliefs for adherence to recommended prenatal health regimens and pregnancy outcomes. *Journal of Reproductive and Infant Psychology,* 11, 97-102.

Tongco, M. D. C. 2007. Purposive sampling as a tool for informant selection. *Ethnobotany Research and Applications,* 5, 147-158.

Topp, L., Barker, B. and Degenhardt, L. 2004. The external validity of results derived from ecstasy users recruited using purposive sampling strategies. *Drug and Alcohol Dependence,* 73, 33-40.

Torres, E., De Monegro, Z. Q., French, L., Swanson, D. P., Guido, J. and Ossip, D. J. 2011. Tobacco use and exposure to secondhand smoke among pregnant women in the Dominican republic: an exploratory look into attitudes, beliefs, perceptions, and practices. *Nicotine & Tobacco Research,* 13, 1220-1227.

Toutain, S. 2010. What women in France say about alcohol abstinence during pregnancy. *Drug Alcohol Rev,* 29**,** 184-188.

Uncu, Y., Ozcakir, A., Ercan, I., Bilgel, N. and Uncu, G. 2005. Pregnant women quit smoking; what about fathers? Survey study in Bursa Region, Turkey. *Croat Med J,* 46**,** 832-837.

Van Der Kooi, R. and Theobald, S. 2006. Traditional medicine in late pregnancy and labour: perceptions of kgaba remedies amongst the Tswana in *South Africa. Afr J Trad CAM,* 3, 11-22.

Van Gelder, M. M., Reefhuis, J., Caton, A. R., Werler, M. M., Druschel, C. M. and Roeleveld, N. 2010. Characteristics of pregnant illicit drug users and associations between cannabis use and perinatal outcome in a population-based study. *Drug Alcohol Depend,* 109**,** 243-247.

Van Manen, M. 1990. Researching lived experience: Human science for an action sensitive pedagogy. *Albany: State University of New York Press.*

Vega, W. A., Kolody, B., Hwang, J. and Noble, A. 1993. Prevalence and magnitude of perinatal substance exposures in California. *N Engl J Med,* 329, 850-854.

Ververs, T., Kaasenbrood, H., Visser, G., Schobben, F., De Jong-Van Den Berg, L. and Egberts, T. 2006. Prevalence and patterns of antidepressant drug use during pregnancy. *Eur J Clin Pharmacol,* 62**,** 863-870.

Vickers, M. and Brackley, K. 2002. Drugs in pregnancy. *Curr Obstet Gynaecol,* 12, 131-137.

Viktil, K. K., Engeland, A. and Furu, K. 2009. Use of antirheumatic drugs in mothers and fathers before and during pregnancy-a population-based cohort study. *Pharmacoepidemiol Drug Saf,* 18**,** 737-742.

Vythilingum, B., Roos, A., Faure, S. C., Geerts, L. and Stein, D. J. 2012. Risk factors for substance use in pregnant women in South Africa. *S Afr Med J,* 102 (11), 851-854.

Ward, R. W. 2001. Difficulties in the study of adverse foetal and neonatal effects of drug therapy during pregnancy. *Semin Perinatol,* 25, 191-195.

Webster, W. S. and Freeman, J. A. D. 2003. Prescription drugs and pregnancy. *Expert Opin Pharmacother,* 4, 949-961.

Weiner, C. P., Buhimschi, C. and Swaan, P. 2005. Drug-prescribing challenges during pregnancy. *Curr Obstet Gynaecol,* 15, 157-165.

Westfall, R. E. 2001. Herbal medicine in pregnancy and childbirth. *Advances in Therapy,* 18, 47-55.

World Health Organisation (WHO) Collaborating Centre for Drug Statistics Methodology ATC/DDD Index. 2014. Available at: http://www.whocc.no/atc_ddd_index/ (Last accessed 26 January 2014).

World Health Organisation. 2011. What is epidemiology? Available at: http://www.who.int/topics/epidemiology/en/ (Last accessed 23 August 2011).

Wulandari, L. P. L. and Whelan, A. K. 2011. Beliefs, attitudes and behaviours of pregnant women in Bali. *Midwifery,* 27, 867-871.

Yamamoto, Y., Kaneita, Y., Yokoyama, E., Sone, T., Takemura, S., Suzuki, K., Kaneko, A. and Ohida, T. 2008. Alcohol consumption and abstention among pregnant Japanese women. *J Epidemiol,* 18**,** 173-182.

Yankowitz, J. and Niebyl J. R., editors. 2001. Drug therapy in pregnancy. *3rd ed. Philadelphia: Lippincott William Wilkins.*

Yeh, H. Y., Chen, Y. C., Chen, F. P., Chou, L. F., Chen, T. J. and Hwang, S. J. 2009. Use of traditional Chinese medicine among pregnant women in Taiwan. *Int J Gynaecol Obstet,* 107**,** 147-150.

Young, N. K. 1997. Effects of alcohol and other drugs on children. *J Psychoact Drugs,* 29, 23-42.

Ystrom, E., Vollrath, M. E. and Nordeng, H. 2012. Effects of personality on use of medications, alcohol, and cigarettes during pregnancy. *Eur J Clin Pharmacol,* 68, 845-851.

Yusuff, K. B. and Omarusehe, L. 2011. Determinants of self medication practices among pregnant women in Ibadan, Nigeria. *Int J Clin Pharm,* 33, 868-875.

Zhu, X., Qi, X., Hao, J., Huang, Z., Zhang, Z., Xing, X., Cheng, D., Xiao, L., Xu, Y., Zhu, P. and Tao, F. 2010. Pattern of drug use during the first trimester among Chinese women: data from a population-based cohort study. *Eur J Clin Pharmacol,* 66**,** 511-518.

Zolnierczuk-Kieliszek, D., Chemperek, E. and Koza, M. 2004. Circumstances of tobacco smoking by pregnant women. *Ann Univ Mariae Curie Sklodowska Med,* 59**,** 163-168.

APPENDICES

Appendix 1 – Patient information sheet, Consent form and Questionnaire (Pilot versions)

Patient Information Sheet v.2 **June 2010**

A multi-centre, cross-sectional surveillance study to estimate the prevalence of prescription, over-the-counter, 'recreational' and complementary drug use in early pregnancy in an ethnically diverse inner-city population in the UK.

We would like to invite you to take part in our research study. Before you decide we would like you to understand why the research is being done and what it would involve for you. One of our team will go through the information sheet with you and answer any questions you have. Ask us if there is anything that is not clear.

It is up to you to decide to join the study. We will describe the study and go through this information sheet. If you agree to take part, we will then ask you to sign a consent form. You are free to withdraw at any time, without giving a reason. This would not affect the standard of care you receive.

We are interested in what prescription medication and other substances women in early pregnancy use. If you agree to take part we will ask you to complete a questionnaire based interview with one of our research team lasting approximately 15 minutes. This interview will be conducted in the antenatal unit after you have attended for your routine ultrasound scan.

We cannot promise the study will help you but the information we get from this study will be of help to doctors, pharmacists, midwives, scientists and pregnant women in the future.

All information which is collected about you during the course of the research will be kept strictly confidential, and any information about you which leaves the hospital will have your name and address removed so that you cannot be recognised. Your GP will not be informed, unless specifically requested by you.

A written report of the findings will be sent to your registered address at the conclusion of the study.

If you withdraw from the study, we will destroy your questionnaire, but we will need to use the data collected up to your withdrawal.

If you have a concern about any aspect of this study, you should ask to speak to the researchers who will do their best to answer your questions or the head of the study Dr Alastair Sutcliffe, Senior Lecturer in Child Health at the UCL Institute of Child Health on 020 7905 2190.

Centre Number:

Study Number:

Patient Identification Number:

CONSENT FORM

A multi-centre, cross-sectional surveillance study to estimate the prevalence of prescription, over-the-counter, 'recreational' and complementary drug use in early pregnancy in an ethnically diverse inner-city population in the UK.

Name of Researcher: Dr Alastair Sutcliffe, Senior Lecturer in Child Health, UCL

1. I confirm that I have read and understand the information sheet dated June 2010 (version 2) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected.

3. I understand that relevant sections of my medical notes and data collected during the study, may be looked at by individuals of the research team, from regulatory authorities or from the NHS Trust, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my records.

4. I agree to take part in the above study.

_____

Name of Patient Date Signature

_____

Name of Person taking consent Date Signature

Medication Use in Pregnancy Questionnaire v.2

Demographic data

1. Age _____

2. Ethnic Origin

1 White	5 Indian	9 Other _____
2 African	6 Pakistani	
3 Black Caribbean	7 Bangladeshi	
4 Black Other	8 Chinese	

Pregnancy data

3. Date of last menstrual period _____

4. How many times have you been pregnant? _____

5. Have you experienced problems before in pregnancy? (e.g. miscarriage/termination) **YES/NO**

If YES please describe _____

6. Have you previously given birth? **YES/NO**

If YES were your previous children fit and healthy? _____

Lifestyle data

7. How many cups of coffee/tea/cola do you now drink per day? _____

Before pregnancy? _____

8. How much alcohol do you now drink per week? _____units

Before pregnancy?_____

(1 unit = 1/2 pint beer or cider/1 glass wine/ 1 measure of spirit)

9. If you smoke how many cigarettes/cigars do you smoke per day? _____

Before pregnancy?_____

Medicines Data

10. a. Are you taking any **PRESCRIPTION** medicines now or have done during your pregnancy so far? **YES/NO**

If YES please describe (under 'Frequency' if Regular give duration/ if When required give times/month)

Name of Medicine	Frequency/When	Indication

b. Were you taking any prescription medicines before pregnancy? **YES/NO**

If YES please describe (including oral contraceptives/morning after pill)

Name of Medicine	Frequency/When	Indication

11. a. Are you taking any **OVER-THE-COUNTER** medicines now or have done during your pregnancy so far? **YES/NO**

If YES please describe (including multi-vitamins)

Name of Medicine	Frequency/When	Indication

b. Were you taking any over-the-counter medicines before pregnancy? **YES/NO**

If YES please describe.

Name of Medicine	Frequency/When	Indication

12. a. Are you taking any **ALTERNATIVE** or **TRADITIONAL** remedies now or have done during your pregnancy so far? **YES/NO**

If YES please describe. (Homeopathic or flower remedies/Aromatherapy massage oils/Herbal or homeopathic from a practitioner)

Name of Therapy	Frequency/When	Indication

b. Were you taking any alternative or traditional remedies before pregnancy? **YES/NO**

If YES please describe.

Name of Therapy	Frequency/When	Indication

13. a. Do you use **RECREATIONAL** drugs now or have done during your pregnancy so far? **YES/NO**

If YES please describe (marijuana, cannabis, cocaine, crack, LSD, amphetamine, ecstasy, heroin).

Name of Drug	Frequency/When	Indication

b. Have you been taking any recreational drugs before pregnancy? **YES/NO**

If YES please describe.

Name of Drug	Frequency/When	Indication

14. If you need more information on medicine/drug use in pregnancy, where would you go?

1 GP 4 Literature 7 Other _____

2 Clinic 5 Internet

3 Pharmacist 6 Friends/family

15. Have you been taking folic acid during your pregnancy? **YES/NO**

Thank you for completing the questionnaire. All responses are strictly confidential.

Appendix 2 – Patient information sheet, Consent form and Questionnaires (Final versions)

Patient Information Sheet v.3 **April 2011**

A multi-centre longitudinal study to estimate the prevalence of prescription, over-the-counter, 'recreational' and complementary drug use in pregnancy and the pregnancy outcomes in an ethnically diverse inner-city population in the UK.

We would like to invite you to take part in our research study. Before you decide we would like you to understand why the research is being done and what it would involve for you. One of our team will go through the information sheet with you and answer any questions you have. Ask us if there is anything that is not clear.

It is up to you to decide to join the study. We will describe the study and go through this information sheet. If you agree to take part, we will then ask you to sign a consent form. You are free to withdraw at any time, without giving a reason. This would not affect the standard of care you receive.

We are interested in what prescription medication and other substances women use during pregnancy. If you agree to take part we will ask you to complete a questionnaire based interview with one of our research team lasting approximately 15 minutes. This interview will be conducted in the antenatal unit after you have attended for your routine ultrasound scan**.** We would also want to know the medicines you are taking in your second and third trimesters by telephoning you. We will request your phone number and agree on a convenient time to call at the end of your first interview. The phone call will take about 6 minutes.

We cannot promise the study will help you but the information we get from this study will be of help to doctors, pharmacists, midwives, scientists and pregnant women in the future.

All information which is collected about you during the course of the research will be kept strictly confidential, and any information about you which leaves the hospital will have your name and address removed so that you cannot be recognised. Your GP will not be informed, unless specifically requested by you.

A written report of the findings will be sent to your registered address at the conclusion of the study.

If you withdraw from the study, we will destroy your questionnaire, but we will need to use the data collected up to your withdrawal.

If you have a concern about any aspect of this study, you should ask to speak to the researchers who will do their best to answer your questions or the head of the study Dr Alastair Sutcliffe, Senior Lecturer in Child Health at the UCL Institute of Child Health on 020 7905 2190.

Centre Number:

Study Number:

Patient Identification Number:

CONSENT FORM

A multi-centre longitudinal study to estimate the prevalence of prescription, over-the-counter, 'recreational' and complementary drug use in pregnancy and the pregnancy outcomes in an ethnically diverse inner-city population in the UK.

Name of Researcher: Dr Alastair Sutcliffe, Senior Lecturer in Child Health, UCL

1. I confirm that I have read and understand the information sheet dated April 2011 (version 3) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected.

3. I understand that relevant sections of my medical notes and data collected during the study, may be looked at by individuals of the research team, from regulatory authorities or from the NHS Trust, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my records.

4. I agree to take part in the above study.

_____

Name of Patient Date Signature Phone number/Time to call

_____

Name of Person taking consent Date Signature

Medication Use in Pregnancy Questionnaire v.3 (Questionnaire for the first trimester interview)

Thank you for agreeing to take part in this study. All responses are strictly confidential.

Demographic data

1. Age _____

2. Ethnic Origin

1 White	5 Indian	9 Other _____
2 African	6 Pakistani	
3 Black Caribbean	7 Bangladeshi	
4 Black Other	8 Chinese	

3. Educational status

1 Secondary	5 Other _____
2 Vocational	
3 University (first degree)	
4 University (post-graduate)	

Pregnancy data

4. Date of last menstrual period _____

5. How many times have you been pregnant? _____

6. Have you experienced problems before in pregnancy? (e.g. miscarriage/termination) **YES/NO**

If YES please describe _____

7. Have you previously given birth? **YES/NO**

If YES were your previous children fit and healthy? _____

Lifestyle data

8. How many cups of coffee/tea/cola do you now drink per day? _____

Before pregnancy? _____

9. How much alcohol do you now drink per week? _____units

Before pregnancy?_____

(1 unit = 1/2 pint beer or cider/1 glass wine/ 1 measure of spirit)

10. If you smoke, how many cigarettes/cigars do you now smoke per day? _____

Before pregnancy?_____

Medicines Data

11. a. Are you taking any **PRESCRIPTION** medicines now or have done during your pregnancy so far? **YES/NO**

If YES please describe (under 'Frequency' if Regular give duration/ if When required give times/month).

Name of Medicine	Frequency/When	Indication

b. In terms of information on the safety of prescription medicines in pregnancy, do you feel you have

1. Enough information 2. Little information 3. No information?

c. Were you taking any prescription medicines before pregnancy? **YES/NO**

If YES please describe. (including oral contraceptives/morning after pill)

Name of Medicine	Frequency/When	Indication

12. a. Are you taking any **OVER-THE-COUNTER** medicines now or have done during your pregnancy so far? **YES/NO**

If YES please describe. (including multi-vitamins)

Name of Medicine	Frequency/When	Indication

b. In terms of information on the safety of over-the-counter medicines in pregnancy, do you feel you have

1. Enough information 2. Little information 3. No information?

c. Were you taking any over-the-counter medicines before pregnancy? **YES/NO**

If YES please describe.

Name of Medicine	Frequency/When	Indication

13. a. Are you taking any **ALTERNATIVE** or **TRADITIONAL** remedies now or have done during your pregnancy so far? **YES/NO**

If YES please describe. (Homeopathic or flower remedies/Aromatherapy massage oils/Herbal or homeopathic from a practitioner)

Name of Therapy	Frequency/When	Indication

b. In terms of information on the safety of alternative or traditional remedies in pregnancy, do you feel you have

1. Enough information 2. Little information 3. No information?

c. What do you think about the safety of alternative or traditional remedies compared with conventional medicines?

1. Safer 2. Equally safe 3. Less safe 4. Don't know

d. Were you taking any alternative or traditional remedies before pregnancy? **YES/NO**

If YES please describe.

Name of Therapy	**Frequency/When**	**Indication**

14. a. Do you use **RECREATIONAL** drugs now or have done during your pregnancy so far? **YES/NO**

If YES please describe (marijuana, cannabis, cocaine, crack, LSD, amphetamine, ecstasy, heroin).

Name of Drug	**Frequency/When**	**Indication**

b. In terms of information on the safety of recreational drugs in pregnancy, do you feel you have

1. Enough information 2. Little information 3. No information?

c. In terms of information on the safety of cigarette and alcohol in pregnancy, do you feel you have

1. Enough information 2. Little information 3. No information?

d. Have you been taking any recreational drugs before pregnancy? **YES/NO**

If YES please describe.

Name of Drug	Frequency/When	Indication

15. Have you been taking folic acid during your pregnancy? **YES/NO**

16. If you were told you have a new medical condition, rank in order which of these types of medicines would you prefer to take? (1 = most preferred, 3 = least preferred)

Prescription medicines Over-the-counter medicines Traditional or alternative remedies

17. If you need more information on medicine/drug use in pregnancy, where would you go?

1 GP 4 Literature (e.g. books) 7 Other _____

2 Clinic (midwife/consultant) 5 Internet

3 Pharmacist 6 Friends/family

Thank you for completing the questionnaire.

Medication Use in Pregnancy Questionnaire v.3 (Questionnaire for the second and third trimester interviews)

Thank you for agreeing to take part in this study. All responses are strictly confidential.

Lifestyle data

1. How many cups of coffee/tea/cola do you now drink per day? _____

2. How much alcohol do you now drink per week? _____units

(1 unit = 1/2 pint beer or cider/1 glass wine/ 1 measure of spirit)

3. If you smoke, how many cigarettes/cigars do you now smoke per day? _____

Medicines Data

4. You were/were not taking any **PRESCRIPTION** medicines the last time, has that changed? Are there any new medicines? **YES/NO**

If YES please describe (under 'Frequency' if Regular give duration/ if When required give times/month).

Name of Medicine	Frequency/When	Indication

5. You were/were not taking any **OVER-THE-COUNTER** medicines the last time, has that changed? Are there any new medicines? **YES/NO**

If YES please describe. (including multi-vitamins)

Name of Medicine	Frequency/When	Indication

6. You were/were not taking any **ALTERNATIVE** or **TRADITIONAL** remedies the last time, has that changed? Are there any new medicines/remedies? **YES/NO**

If YES please describe. (Homeopathic or flower remedies/Aromatherapy massage oils/Herbal or homeopathic from a practitioner)

Name of Therapy	Frequency/When	Indication

7. You were/were not taking any **RECREATIONAL** drugs the last time, has that changed? Are there any drugs you are taking now? **YES/NO**

If YES please describe (marijuana, cannabis, cocaine, crack, LSD, amphetamine, ecstasy, heroin).

Name of Drug	Frequency/When	Indication

Thank you.

Appendix 3 – Univariate associations between participants' characteristics and medicine or substance use in early pregnancy (Cross-sectional study, N = 560)

Univariate associations between participants' characteristics and prescription medicine use in early pregnancy

Characteristic	Users (n = 155)	Non-users (n = 405)	*p* value
	n (%)	n (%)	
Age *(years)*			0.133
≤ 20	1 (0.6)	11 (2.7)	
21 – 30	53 (34.2)	141 (34.8)	
31 – 40	90 (58.1)	239 (59.0)	
41 – 50	11 (7.1)	14 (3.5)	
Ethnic Origin			0.848
White	103 (66.5)	271 (66.9)	
Black origin	21 (13.5)	47 (11.6)	
Asian	12 (7.7)	39 (9.6)	
Other	19 (12.3)	48 (11.9)	
Educational status			0.029
Below university qualification	30 (19.4)	115 (28.4)	
University qualification	125 (80.6)	290 (71.6)	
Gravidity			0.043
1	48 (31.0)	163 (40.2)	
≥ 2	107 (69.0)	242 (59.8)	
Previous obstetric problems			0.304
Yes	59 (55.1)	119 (49.2)	
No	48 (44.9)	123 (50.8)	
Parity			0.368
0	78 (50.3)	221 (54.6)	
≥ 1	77 (49.7)	184 (45.4)	
Previous healthy child(ren)			0.236
Yes	72 (93.5)	178 (96.7)	
No	5 (6.5)	6 (3.3)	
Lifestyle variables (early pregnancy)			
Coffee			0.251
Yes	42 (27.1)	130 (32.1)	

No	113 (72.9)	275 (67.9)	
Tea			0.654
Yes	71 (45.8)	177 (43.7)	
No	84 (54.2)	228 (56.3)	
Cola			0.166
Yes	23 (14.8)	43 (10.6)	
No	132 (85.2)	362 (89.4)	

Univariate associations between participants' characteristics and over-the-counter medicine use in early pregnancy

Characteristic	**Users (n = 143)**	**Non-users (n = 417)**	***p* value**
	n (%)	**n (%)**	
Age *(years)*			<0.0001
≤ 20	3 (2.1)	9 (2.2)	
21 – 30	29 (20.3)	165 (39.6)	
31 – 40	107 (74.8)	222 (53.2)	
41 – 50	4 (2.8)	21 (5.0)	
Ethnic Origin			0.002
White	112 (78.3)	262 (62.8)	
Black origin	10 (7.0)	58 (13.9)	
Asian	5 (3.5)	46 (11.0)	
Other	16 (11.2)	51 (12.2)	
Educational status			0.008
Below university qualification	25 (17.5)	120 (28.8)	
University qualification	118 (82.5)	297 (71.2)	
Gravidity			0.076
1	45 (31.5)	166 (39.8)	
≥ 2	98 (68.5)	251 (60.2)	
Previous obstetric problems			0.637
Yes	48 (49.0)	130 (51.8)	
No	50 (51.0)	121 (48.2)	

Parity			0.009
0	63 (44.1)	236 (56.6)	
≥ 1	80 (55.9)	181 (43.4)	
Previous healthy child(ren)			0.277
Yes	75 (93.8)	175 (96.7)	
No	5 (6.3)	6 (3.3)	
Lifestyle variables (early pregnancy)			
Coffee			0.202
Yes	50 (35.0)	122 (29.3)	
No	93 (65.0)	295 (70.7)	
Tea			0.004
Yes	78 (54.5)	170 (40.8)	
No	65 (45.5)	247 (59.2)	
Cola			0.344
Yes	20 (14.0)	46 (11.0)	
No	123 (86.0)	371 (89.0)	

Univariate associations between participants' characteristics and complementary and alternative medicine use in early pregnancy

Characteristic	**Users (n = 227)**	**Non-users (n = 333)**	***p* value**
	n (%)	**n (%)**	
Age *(years)*			<0.0001
≤ 20	1 (0.4)	11 (3.3)	
21 – 30	54 (23.8)	140 (42.0)	
31 – 40	157 (69.2)	172 (51.7)	
41 – 50	15 (6.6)	10 (3.0)	
Ethnic Origin			0.001
White	168 (74.0)	206 (61.9)	
Black origin	15 (6.6)	53 (15.9)	
Asian	14 (6.2)	37 (11.1)	
Other	30 (13.2)	37 (11.1)	

Educational status			<0.0001
Below university qualification	33 (14.5)	112 (33.6)	
University qualification	194 (85.5)	221 (66.4)	
Gravidity			0.331
1	91 (40.1)	120 (36.0)	
≥ 2	136 (59.9)	213 (64.0)	
Previous obstetric problems			0.216
Yes	75 (55.1)	103 (48.4)	
No	61 (44.9)	110 (51.6)	
Parity			0.091
0	131 (57.7)	168 (50.5)	
≥ 1	96 (42.3)	165 (49.5)	
Previous healthy child(ren)			0.542
Yes	91 (94.8)	159 (96.4)	
No	5 (5.2)	6 (3.6)	
Lifestyle variables (early pregnancy)			
Coffee			0.022
Yes	82 (36.1)	90 (27.0)	
No	145 (63.9)	243 (73.0)	
Tea			0.438
Yes	105 (46.3)	143 (42.9)	
No	122 (53.7)	190 (57.1)	
Cola			0.462
Yes	24 (10.6)	42 (12.6)	
No	203 (89.4)	291 (87.4)	

Univariate associations between participants' characteristics and alcohol consumption in early pregnancy

Characteristic	Users (n = 64)	Non-users (n = 496)	*p* value
	n (%)	n (%)	
Age *(years)*			<0.0001
≤ 20	0 (0.0)	12 (2.4)	
21 – 30	8 (12.5)	186 (37.5)	
31 – 40	55 (85.9)	274 (55.2)	
41 – 50	1 (1.6)	24 (4.8)	
Ethnic Origin			0.080
White	51 (79.7)	323 (65.1)	
Black origin	4 (6.3)	64 (12.9)	
Asian	2 (3.1)	49 (9.9)	
Other	7 (10.9)	60 (12.1)	
Educational status			0.004
Below university qualification	7 (10.9)	138 (27.8)	
University qualification	57 (89.1)	358 (72.2)	
Gravidity			0.094
1	18 (28.1)	193 (38.9)	
≥ 2	46 (71.9)	303 (61.1)	
Previous obstetric problems			0.865
Yes	24 (52.2)	154 (50.8)	
No	22 (47.8)	149 (49.2)	
Parity			0.056
0	27 (42.2)	272 (54.8)	
≥ 1	37 (57.8)	224 (45.2)	
Previous healthy child(ren)			0.621
Yes	36 (97.3)	214 (95.5)	
No	1 (2.7)	10 (4.5)	
Lifestyle variables (early pregnancy)			
Coffee			0.124
Yes	25 (39.1)	147 (29.6)	

No	39 (60.9)	349 (70.4)	
Tea			0.001
Yes	41 (64.1)	207 (41.7)	
No	23 (35.9)	289 (58.3)	
Cola			0.851
Yes	8 (12.5)	58 (11.7)	
No	56 (87.5)	438 (88.3)	

Univariate associations between participants' characteristics and cigarette smoking in early pregnancy

Characteristic	**Users (n = 17)**	**Non-users (n = 543)**	***p* value**
	n (%)	**n (%)**	
Age *(years)*			0.002
≤ 20	2 (11.8)	10 (1.8)	
21 – 30	9 (52.9)	185 (34.1)	
31 – 40	4 (23.5)	325 (59.9)	
41 – 50	2 (11.8)	23 (4.2)	
Ethnic Origin			0.971
White	12 (70.6)	362 (66.7)	
Black origin	2 (11.8)	66 (12.2)	
Asian	1 (5.9)	50 (9.2)	
Other	2 (11.8)	65 (12.0)	
Educational status			<0.0001
Below university qualification	14 (82.4)	131 (24.1)	
University qualification	3 (17.6)	412 (75.9)	
Gravidity			0.221
1	4 (23.5)	207 (38.1)	
≥ 2	13 (76.5)	336 (61.9)	
Previous obstetric problems			0.180
Yes	9 (69.2)	169 (50.3)	
No	4 (30.8)	167 (49.7)	

Parity			0.595
0	8 (47.1)	291 (53.6)	
≥ 1	9 (52.9)	252 (46.4)	
Previous healthy child(ren)			0.522
Yes	9 (100.0)	241 (95.6)	
No	0 (0.0)	11 (4.4)	
Lifestyle variables (early pregnancy)			
Coffee			0.044
Yes	9 (52.9)	163 (30.0)	
No	8 (47.1)	380 (70.0)	
Tea			0.793
Yes	7 (41.2)	241 (44.4)	
No	10 (58.8)	302 (55.6)	
Cola			<0.0001
Yes	7 (41.2)	59 (10.9)	
No	10 (58.8)	484 (89.1)	

Univariate associations between participants' characteristics and cannabis use in early pregnancy

Characteristic	**Users (n = 2)**	**Non-users (n = 558)**	***p* value**
	n (%)	**n (%)**	
Age *(years)*			0.018
≤ 20	0 (0.0)	12 (2.2)	
21 – 30	0 (0.0)	194 (34.8)	
31 – 40	1 (50.0)	328 (58.8)	
41 – 50	1 (50.0)	24 (4.3)	
Ethnic Origin			0.401
White	1 (50.0)	373 (66.8)	
Black origin	0 (0.0)	68 (12.2)	
Asian	0 (0.0)	51 (9.1)	
Other	1 (50.0)	66 (11.8)	

Educational status			0.402
Below university qualification	0 (0.0)	145 (26.0)	
University qualification	2 (100.0)	413 (74.0)	
Gravidity			0.271
1	0 (0.0)	211 (37.8)	
≥ 2	2 (100.0)	347 (62.2)	
Previous obstetric problems			0.164
Yes	2 (100.0)	176 (50.7)	
No	0 (0.0)	171 (49.3)	
Parity			0.923
0	1 (50.0)	298 (53.4)	
≥ 1	1 (50.0)	260 (46.6)	
Previous healthy child(ren)			0.834
Yes	1 (100.0)	249 (95.8)	
No	0 (0.0)	11 (4.2)	
Lifestyle variables (early pregnancy)			
Coffee			0.346
Yes	0 (0.0)	172 (30.8)	
No	2 (100.0)	386 (69.2)	
Tea			0.112
Yes	2 (100.0)	246 (44.1)	
No	0 (0.0)	312 (55.9)	
Cola			0.605
Yes	0 (0.0)	66 (11.8)	
No	2 (100.0)	492 (88.2)	

Appendix 4 – Multivariate analyses with Logistic regression (Cross-sectional study, N = 560)

Variable	Adjusted OR	95% CI	Significance
Prescription medicines[a]			
Educational status			
Below university qualification	Ref	Ref	Ref
University qualification	1.895	1.134 - 3.168	0.015
Gravidity			
1	Ref	Ref	Ref
≥ 2	1.565	1.032 - 2.372	0.035
Over-the-counter medicines[b]			
Age *(years)*			
≤ 20	1.617	0.358 – 7.308	0.532
21 – 30	0.482	0.293 – 0.793	0.004
31 – 40	Ref	Ref	Ref
41 – 50	0.378	0.124 – 1.153	0.087
Ethnic Origin			
White	Ref	Ref	Ref
Black origin	0.394	0.184 – 0.845	0.017
Asian	0.247	0.094 – 0.652	0.005
Other	0.758	0.405 – 1.419	0.386
Parity			
0	Ref	Ref	Ref
≥ 1	1.740	1.153 – 2.628	0.008
Tea			
No	Ref	Ref	Ref
Yes	1.779	1.190 – 2.661	0.005
Complementary and alternative medicines[c]			
Age *(years)*			
≤ 20	0.211	0.025 – 1.757	0.150
21 – 30	0.539	0.355 – 0.819	0.004
31 – 40	Ref	Ref	Ref

41 – 50	1.515	0.653 – 3.517	0.334
Educational status			
Below university qualification	Ref	Ref	Ref
University qualification	1.947	1.200 – 3.161	0.007
Alcohol[d]			
Age *(years)*			
≤ 20	0.000	0.000 – .	0.999
21 – 30	0.300	0.133 – 0.674	0.004
31 – 40	Ref	Ref	Ref
41 – 50	0.199	0.026 – 1.530	0.121
Tea			
No	Ref	Ref	Ref
Yes	2.522	1.438 – 4.424	0.001
Cigarette[e]			
Educational status			
Below university qualification	Ref	Ref	Ref
University qualification	0.081	0.021 – 0.317	<0.0001
Coffee			
No	Ref	Ref	Ref
Yes	2.947	1.031 – 8.423	0.044

[a]Odds ratio adjusted for age, ethnic origin, education and gravidity.

[b]Odds ratio adjusted for age, ethnic origin, education, parity and tea consumption.

[c]Odds ratio adjusted for age, ethnic origin, education, parity and coffee consumption.

[d]Odds ratio adjusted for age, ethnic origin, education, parity and tea consumption.

[e]Odds ratio adjusted for age, education, and coffee consumption.

Appendix 5 – Univariate associations between use of medicines and recreational substances in the first trimester and the pregnancy outcomes (First trimester cohort, N = 455)

Prevalence of concomitant use of medicines and recreational substances in the first trimester (N = 455)

Medicine/Substance	Prevalence of use (%)
POM + OTC	8.1
POM + CAM	11.9
OTC + CAM	14.3
POM + OTC + CAM	4.0
Alcohol + Cigarette	0.0
POM + Alcohol	2.0
POM + Cigarette	0.4
POM + OTC + Alcohol	0.7
POM + OTC + Cigarette	0.0
POM + CAM + Alcohol	0.9
POM + CAM + Cigarette	0.0
OTC + Alcohol	4.8
OTC + Cigarette	0.0
OTC + CAM + Alcohol	2.6
OTC + CAM + Cigarette	0.0
CAM + Alcohol	5.9
CAM + Cigarette	0.9
POM + OTC + CAM + Alcohol	0.4
POM + OTC + CAM + Cigarette	0.0

*POM = Prescription medicines; OTC = Over-the-counter medicines; CAM = Complementary and alternative medicines

Univariate associations between use of medicines and recreational substances in the first trimester and congenital anomaly

Variable	Congenital anomaly No	Yes	*p* value
	n (%)	n (%)	
Age *(years)*			0.720
≤ 20	10 (3.0)	0 (0.0)	
21 – 30	98 (29.6)	5 (38.5)	
31 – 40	210 (63.4)	7 (53.8)	
41 – 50	13 (3.9)	1 (7.7)	
Ethnic Origin			0.643
White	236 (71.3)	11 (84.6)	
Black origin	25 (7.6)	1 (7.7)	
Asian	29 (8.8)	0 (0.0)	
Other	41 (12.4)	1 (7.7)	
Educational status			0.532
Below university qualification	77 (23.3)	4 (30.8)	
University qualification	254 (76.7)	9 (69.2)	
Gravidity			0.924
1	123 (37.2)	5 (38.5)	
≥ 2	208 (62.8)	8 (61.5)	
Previous obstetric problems			0.335
No	94 (45.2)	5 (62.5)	
Yes	114 (54.8)	3 (37.5)	
Parity			0.502
0	184 (55.6)	6 (46.2)	
≥ 1	147 (44.4)	7 (53.8)	
Previous healthy child(ren)			0.330
No	8 (5.4)	1 (14.3)	
Yes	139 (94.6)	6 (85.7)	
Coffee			0.853
No	237 (71.6)	9 (69.2)	
Yes	94 (28.4)	4 (30.8)	
Tea			0.545
No	181 (54.7)	6 (46.2)	

Yes	150 (45.3)	7 (53.8)	
Cola			0.612
No	290 (87.6)	12 (92.3)	
Yes	41 (12.4)	1 (7.7)	
POM			0.344
No	243 (73.4)	8 (61.5)	
Yes	88 (26.6)	5 (38.5)	
OTC			0.891
No	235 (71.0)	9 (69.2)	
Yes	96 (29.0)	4 (30.8)	
CAM			0.461
No	187 (56.5)	6 (46.2)	
Yes	144 (43.5)	7 (53.8)	
Alcohol			0.593
No	289 (87.3)	12 (92.3)	
Yes	42 (12.7)	1 (7.7)	
Cigarette			0.191
No	324 (97.9)	12 (92.3)	
Yes	7 (2.1)	1 (7.7)	
POM + OTC			0.358
No	304 (91.8)	11 (84.6)	
Yes	27 (8.2)	2 (15.4)	
POM + CAM			0.189
No	294 (88.8)	10 (76.9)	
Yes	37 (11.2)	3 (23.1)	
OTC + CAM			0.333
No	286 (86.4)	10 (76.9)	
Yes	45 (13.6)	3 (23.1)	
POM+OTC+CAM			0.400
No	320 (96.7)	12 (92.3)	
Yes	11 (3.3)	1 (7.7)	
POM + Alcohol			0.141
No	325 (98.2)	12 (92.3)	
Yes	6 (1.8)	1 (7.7)	
POM + Cigarette			0.779
No	329 (99.4)	13 (100.0)	
Yes	2 (0.6)	0 (0.0)	

POM+OTC+Alcohol			0.730
No	328 (99.1)	13 (100.0)	
Yes	3 (0.9)	0 (0.0)	
POM+CAM+Alcohol			0.025
No	328 (99.1)	12 (92.3)	
Yes	3 (0.9)	1 (7.7)	
OTC + Alcohol			0.374
No	312 (94.3)	13 (100.0)	
Yes	19 (5.7)	0 (0.0)	
OTC+CAM+Alcohol			0.525
No	321 (97.0)	13 (100.0)	
Yes	10 (3.0)	0 (0.0)	
CAM + Alcohol			0.882
No	309 (93.4)	12 (92.3)	
Yes	22 (6.6)	1 (7.7)	
CAM + Cigarette			0.001
No	330 (99.7)	12 (92.3)	
Yes	1 (0.3)	1 (7.7)	
POM + OTC + CAM + Alcohol			0.779
No	329 (99.4)	13 (100.0)	
Yes	2 (0.6)	0 (0.0)	

Univariate associations between use of medicines and recreational substances in the first trimester and low birth weight

Variable	Low birth weight No	Yes	*p* value
	n (%)	n (%)	
Age *(years)*			0.352
≤ 20	8 (2.5)	1 (5.6)	
21 – 30	94 (29.1)	8 (44.4)	
31 – 40	207 (64.1)	9 (50.0)	
41 – 50	14 (4.3)	0 (0.0)	
Ethnic Origin			0.001
White	235 (72.8)	9 (50.0)	
Black origin	26 (8.0)	0 (0.0)	
Asian	23 (7.1)	6 (33.3)	
Other	39 (12.1)	3 (16.7)	
Educational status			0.634
Below university qualification	74 (22.9)	5 (27.8)	
University qualification	249 (77.1)	13 (72.2)	
Gravidity			0.099
1	117 (36.2)	10 (55.6)	
≥ 2	206 (63.8)	8 (44.4)	
Previous obstetric problems			0.829
No	95 (46.1)	4 (50.0)	
Yes	111 (53.9)	4 (50.0)	
Parity			0.134
0	175 (54.2)	13 (72.2)	
≥ 1	148 (45.8)	5 (27.8)	
Previous healthy child(ren)			0.570
No	9 (6.1)	0 (0.0)	
Yes	139 (93.9)	5 (100.0)	
Coffee			0.530
No	229 (70.9)	14 (77.8)	
Yes	94 (29.1)	4 (22.2)	
Tea			0.565
No	175 (54.2)	11 (61.1)	

Yes	148 (45.8)	7 (38.9)	
Cola			0.534
No	285 (88.2)	15 (83.3)	
Yes	38 (11.8)	3 (16.7)	
POM			0.086
No	239 (74.0)	10 (55.6)	
Yes	84 (26.0)	8 (44.4)	
OTC			0.513
No	228 (70.6)	14 (77.8)	
Yes	95 (29.4)	4 (22.2)	
CAM			0.989
No	180 (55.7)	10 (55.6)	
Yes	143 (44.3)	8 (44.4)	
Alcohol			0.354
No	281 (87.0)	17 (94.4)	
Yes	42 (13.0)	1 (5.6)	
Cigarette			0.499
No	315 (97.5)	18 (100.0)	
Yes	8 (2.5)	0 (0.0)	
POM + OTC			0.673
No	296 (91.6)	17 (94.4)	
Yes	27 (8.4)	1 (5.6)	
POM + CAM			0.504
No	286 (88.5)	15 (83.3)	
Yes	37 (11.5)	3 (16.7)	
OTC + CAM			0.745
No	278 (86.1)	15 (83.3)	
Yes	45 (13.9)	3 (16.7)	
POM+OTC+CAM			0.630
No	312 (96.6)	17 (94.4)	
Yes	11 (3.4)	1 (5.6)	
POM + Alcohol			0.528
No	316 (97.8)	18 (100.0)	
Yes	7 (2.2)	0 (0.0)	
POM + Cigarette			0.738
No	321 (99.4)	18 (100.0)	
Yes	2 (0.6)	0 (0.0)	

POM+OTC+Alcohol			0.681
No	320 (99.1)	18 (100.0)	
Yes	3 (0.9)	0 (0.0)	
POM+CAM+Alcohol			0.635
No	319 (98.8)	18 (100.0)	
Yes	4 (1.2)	0 (0.0)	
OTC + Alcohol			0.290
No	304 (94.1)	18 (100.0)	
Yes	19 (5.9)	0 (0.0)	
OTC+CAM+Alcohol			0.449
No	313 (96.9)	18 (100.0)	
Yes	10 (3.1)	0 (0.0)	
CAM + Alcohol			0.241
No	300 (92.9)	18 (100.0)	
Yes	23 (7.1)	0 (0.0)	
CAM + Cigarette			0.738
No	321 (99.4)	18 (100.0)	
Yes	2 (0.6)	0 (0.0)	
POM + OTC + CAM + Alcohol			0.738
No	321 (99.4)	18 (100.0)	
Yes	2 (0.6)	0 (0.0)	

Univariate associations between use of medicines and recreational substances in the first trimester and preterm birth

	Preterm birth		
Variable	**No**	**Yes**	***p* value**
	n (%)	**n (%)**	
Age *(years)*			0.205
≤ 20	8 (2.5)	1 (3.8)	
21 – 30	90 (28.6)	12 (46.2)	
31 – 40	203 (64.4)	13 (50.0)	
41 – 50	14 (4.4)	0 (0.0)	
Ethnic Origin			0.189
White	229 (72.7)	15 (57.7)	
Black origin	24 (7.6)	2 (7.7)	
Asian	24 (7.6)	5 (19.2)	
Other	38 (12.1)	4 (15.4)	
Educational status			0.150
Below university qualification	70 (22.2)	9 (34.6)	
University qualification	245 (77.8)	17 (65.4)	
Gravidity			0.894
1	117 (37.1)	10 (38.5)	
≥ 2	198 (62.9)	16 (61.5)	
Previous obstetric problems			0.176
No	89 (44.9)	10 (62.5)	
Yes	109 (55.1)	6 (37.5)	
Parity			0.584
0	175 (55.6)	13 (50.0)	
≥ 1	140 (44.4)	13 (50.0)	
Previous healthy child(ren)			0.128
No	7 (5.0)	2 (15.4)	
Yes	133 (95.0)	11 (84.6)	
Coffee			0.507
No	223 (70.8)	20 (76.9)	
Yes	92 (29.2)	6 (23.1)	
Tea			0.248
No	169 (53.7)	17 (65.4)	

Yes	146 (46.3)	9 (34.6)	
Cola			0.584
No	278 (88.3)	22 (84.6)	
Yes	37 (11.7)	4 (15.4)	
POM			0.067
No	234 (74.3)	15 (57.7)	
Yes	81 (25.7)	11 (42.3)	
OTC			0.486
No	222 (70.5)	20 (76.9)	
Yes	93 (29.5)	6 (23.1)	
CAM			0.841
No	176 (55.9)	14 (53.8)	
Yes	139 (44.1)	12 (46.2)	
Alcohol			0.161
No	273 (86.7)	25 (96.2)	
Yes	42 (13.3)	1 (3.8)	
Cigarette			0.411
No	307 (97.5)	26 (100.0)	
Yes	8 (2.5)	0 (0.0)	
POM + OTC			0.920
No	289 (91.7)	24 (92.3)	
Yes	26 (8.3)	2 (7.7)	
POM + CAM			0.547
No	279 (88.6)	22 (84.6)	
Yes	36 (11.4)	4 (15.4)	
OTC + CAM			0.842
No	271 (86.0)	22 (84.6)	
Yes	44 (14.0)	4 (15.4)	
POM+OTC+CAM			0.925
No	304 (96.5)	25 (96.2)	
Yes	11 (3.5)	1 (3.8)	
POM + Alcohol			0.442
No	308 (97.8)	26 (100.0)	
Yes	7 (2.2)	0 (0.0)	
POM + Cigarette			0.684
No	313 (99.4)	26 (100.0)	
Yes	2 (0.6)	0 (0.0)	

POM+OTC+Alcohol			0.617
No	312 (99.0)	26 (100.0)	
Yes	3 (1.0)	0 (0.0)	
POM+CAM+Alcohol			0.563
No	311 (98.7)	26 (100.0)	
Yes	4 (1.3)	0 (0.0)	
OTC + Alcohol			0.197
No	296 (94.0)	26 (100.0)	
Yes	19 (6.0)	0 (0.0)	
OTC+CAM+Alcohol			0.356
No	305 (96.8)	26 (100.0)	
Yes	10 (3.2)	0 (0.0)	
CAM + Alcohol			0.154
No	292 (92.7)	26 (100.0)	
Yes	23 (7.3)	0 (0.0)	
CAM + Cigarette			0.684
No	313 (99.4)	26 (100.0)	
Yes	2 (0.6)	0 (0.0)	
POM + OTC + CAM + Alcohol			0.684
No	313 (99.4)	26 (100.0)	
Yes	2 (0.6)	0 (0.0)	

Univariate associations between use of medicines and recreational substances in the first trimester and admission to NNU

Variable	Admission to NNU No	Yes	*p* value
	n (%)	n (%)	
Age *(years)*			0.053
≤ 20	7 (2.3)	3 (6.8)	
21 – 30	85 (28.3)	18 (40.9)	
31 – 40	194 (64.7)	23 (52.3)	
41 – 50	14 (4.7)	0 (0.0)	
Ethnic Origin			0.244
White	219 (73.0)	28 (63.6)	
Black origin	24 (8.0)	2 (4.5)	
Asian	23 (7.7)	6 (13.6)	
Other	34 (11.3)	8 (18.2)	
Educational status			0.315
Below university qualification	68 (22.7)	13 (29.5)	
University qualification	232 (77.3)	31 (70.5)	
Gravidity			0.380
1	109 (36.3)	19 (43.2)	
≥ 2	191 (63.7)	25 (56.8)	
Previous obstetric problems			0.131
No	84 (44.0)	15 (60.0)	
Yes	107 (56.0)	10 (40.0)	
Parity			0.821
0	165 (55.0)	25 (56.8)	
≥ 1	135 (45.0)	19 (43.2)	
Previous healthy child(ren)			0.353
No	7 (5.2)	2 (10.5)	
Yes	128 (94.8)	17 (89.5)	
Coffee			0.868
No	215 (71.7)	31 (70.5)	
Yes	85 (28.3)	13 (29.5)	
Tea			0.100
No	158 (52.7)	29 (65.9)	

Yes	142 (47.3)	15 (34.1)	
Cola			0.242
No	261 (87.0)	41 (93.2)	
Yes	39 (13.0)	3 (6.8)	
POM			0.745
No	218 (72.7)	33 (75.0)	
Yes	82 (27.3)	11 (25.0)	
OTC			0.524
No	211 (70.3)	33 (75.0)	
Yes	89 (29.7)	11 (25.0)	
CAM			0.823
No	169 (56.3)	24 (54.5)	
Yes	131 (43.7)	20 (45.5)	
Alcohol			0.464
No	261 (87.0)	40 (90.9)	
Yes	39 (13.0)	4 (9.1)	
Cigarette			0.273
No	292 (97.3)	44 (100.0)	
Yes	8 (2.7)	0 (0.0)	
POM + OTC			0.680
No	274 (91.3)	41 (93.2)	
Yes	26 (8.7)	3 (6.8)	
POM + CAM			0.574
No	264 (88.0)	40 (90.9)	
Yes	36 (12.0)	4 (9.1)	
OTC + CAM			0.689
No	259 (86.3)	37 (84.1)	
Yes	41 (13.7)	7 (15.9)	
POM+OTC+CAM			0.682
No	290 (96.7)	42 (95.5)	
Yes	10 (3.3)	2 (4.5)	
POM + Alcohol			0.905
No	294 (98.0)	43 (97.7)	
Yes	6 (2.0)	1 (2.3)	
POM + Cigarette			0.587
No	298 (99.3)	44 (100.0)	
Yes	2 (0.7)	0 (0.0)	

POM+OTC+Alcohol			0.505
No	297 (99.0)	44 (100.0)	
Yes	3 (1.0)	0 (0.0)	
POM+CAM+Alcohol			0.441
No	296 (98.7)	44 (100.0)	
Yes	4 (1.3)	0 (0.0)	
OTC + Alcohol			0.312
No	282 (94.0)	43 (97.7)	
Yes	18 (6.0)	1 (2.3)	
OTC+CAM+Alcohol			0.219
No	290 (96.7)	44 (100.0)	
Yes	10 (3.3)	0 (0.0)	
CAM + Alcohol			0.209
No	278 (92.7)	43 (97.7)	
Yes	22 (7.3)	1 (2.3)	
CAM + Cigarette			0.587
No	298 (99.3)	44 (100.0)	
Yes	2 (0.7)	0 (0.0)	
POM + OTC + CAM + Alcohol			0.587
No	298 (99.3)	44 (100.0)	
Yes	2 (0.7)	0 (0.0)	

Univariate associations between use of medicines and recreational substances in the first trimester and other problems

	Other problems		
Variable	**No**	**Yes**	***p* value**
	n (%)	**n (%)**	
Age *(years)*			0.127
≤ 20	6 (2.1)	4 (7.7)	
21 – 30	89 (30.5)	14 (26.9)	
31 – 40	184 (63.0)	33 (63.5)	
41 – 50	13 (4.5)	1 (1.9)	
Ethnic Origin			0.357
White	208 (71.2)	39 (75.0)	
Black origin	20 (6.8)	6 (11.5)	
Asian	27 (9.2)	2 (3.8)	
Other	37 (12.7)	5 (9.6)	
Educational status			0.789
Below university qualification	68 (23.3)	13 (25.0)	
University qualification	224 (76.7)	39 (75.0)	
Gravidity			0.674
1	110 (37.7)	18 (34.6)	
≥ 2	182 (62.3)	34 (65.4)	
Previous obstetric problems			<0.0001
No	94 (51.6)	5 (14.7)	
Yes	88 (48.4)	29 (85.3)	
Parity			0.195
0	157 (53.8)	33 (63.5)	
≥ 1	135 (46.2)	19 (36.5)	
Previous healthy child(ren)			0.246
No	9 (6.7)	0 (0.0)	
Yes	126 (93.3)	19 (100.0)	
Coffee			0.003
No	200 (68.5)	46 (88.5)	
Yes	92 (31.5)	6 (11.5)	
Tea			0.058
No	165 (56.5)	22 (42.3)	

Yes	127 (43.5)	30 (57.7)	
Cola			0.448
No	258 (88.4)	44 (84.6)	
Yes	34 (11.6)	8 (15.4)	
POM			0.510
No	215 (73.6)	36 (69.2)	
Yes	77 (26.4)	16 (30.8)	
OTC			0.532
No	209 (71.6)	35 (67.3)	
Yes	83 (28.4)	17 (32.7)	
CAM			0.580
No	162 (55.5)	31 (59.6)	
Yes	130 (44.5)	21 (40.4)	
Alcohol			0.820
No	255 (87.3)	46 (88.5)	
Yes	37 (12.7)	6 (11.5)	
Cigarette			0.074
No	287 (98.3)	49 (94.2)	
Yes	5 (1.7)	3 (5.8)	
POM + OTC			0.381
No	269 (92.1)	46 (88.5)	
Yes	23 (7.9)	6 (11.5)	
POM + CAM			0.654
No	259 (88.7)	45 (86.5)	
Yes	33 (11.3)	7 (13.5)	
OTC + CAM			0.746
No	252 (86.3)	44 (84.6)	
Yes	40 (13.7)	8 (15.4)	
POM+OTC+CAM			0.879
No	282 (96.6)	50 (96.2)	
Yes	10 (3.4)	2 (3.8)	
POM + Alcohol			0.315
No	287 (98.3)	50 (96.2)	
Yes	5 (1.7)	2 (3.8)	
POM + Cigarette			0.167
No	291 (99.7)	51 (98.1)	
Yes	1 (0.3)	1 (1.9)	

POM+OTC+Alcohol			0.376
No	290 (99.3)	51 (98.1)	
Yes	2 (0.7)	1 (1.9)	
POM+CAM+Alcohol			0.396
No	288 (98.6)	52 (100.0)	
Yes	4 (1.4)	0 (0.0)	
OTC + Alcohol			0.933
No	276 (94.5)	49 (94.2)	
Yes	16 (5.5)	3 (5.8)	
OTC+CAM+Alcohol			0.647
No	283 (96.9)	51 (98.1)	
Yes	9 (3.1)	1 (1.9)	
CAM + Alcohol			0.374
No	271 (92.8)	50 (96.2)	
Yes	21 (7.2)	2 (3.8)	
CAM + Cigarette			0.549
No	290 (99.3)	52 (100.0)	
Yes	2 (0.7)	0 (0.0)	
POM + OTC + CAM + Alcohol			0.549
No	290 (99.3)	52 (100.0)	
Yes	2 (0.7)	0 (0.0)	

Appendix 6 – Univariate associations between use of medicines and recreational substances in at least one trimester and the pregnancy outcomes (Cohort with complete interviews, N = 231)

Prevalence of concomitant use of medicines and recreational substances in at least one trimester (N = 231)

Medicine/Substance	Prevalence of use (%)
POM + OTC	15.6
POM + CAM	16.9
OTC + CAM	30.3
POM + OTC + CAM	8.7
Alcohol + Cigarette	0.0
POM + Alcohol	3.5
POM + Cigarette	0.9
POM + OTC + Alcohol	2.2
POM + OTC + Cigarette	0.4
POM + CAM + Alcohol	1.7
POM + CAM + Cigarette	0.0
OTC + Alcohol	10.4
OTC + Cigarette	1.3
OTC + CAM + Alcohol	6.9
OTC + CAM + Cigarette	0.9
CAM + Alcohol	10.0
CAM + Cigarette	0.9
POM + OTC + CAM + Alcohol	1.3
POM + OTC + CAM + Cigarette	0.0

*POM = Prescription medicines; OTC = Over-the-counter medicines; CAM = Complementary and alternative medicines

Univariate associations between use of medicines and recreational substances in at least one trimester and congenital anomaly

Variable	Congenital anomaly No	Yes	*p* value
	n (%)	n (%)	
Age *(years)*			0.762
≤ 20	6 (3.0)	0 (0.0)	
21 – 30	55 (27.8)	3 (42.9)	
31 – 40	127 (64.1)	4 (57.1)	
41 – 50	10 (5.1)	0 (0.0)	
Ethnic Origin			0.542
White	145 (73.2)	6 (85.7)	
Black origin	13 (6.6)	1 (14.3)	
Asian	17 (8.6)	0 (0.0)	
Other	23 (11.6)	0 (0.0)	
Educational status			0.658
Below university qualification	42 (21.2)	1 (14.3)	
University qualification	156 (78.8)	6 (85.7)	
Gravidity			0.196
1	76 (38.4)	1 (14.3)	
≥ 2	122 (61.6)	6 (85.7)	
Previous obstetric problems			0.691
No	51 (41.8)	3 (50.0)	
Yes	71 (58.2)	3 (50.0)	
Parity			0.135
0	113 (57.1)	2 (28.6)	
≥ 1	85 (42.9)	5 (71.4)	
Previous healthy child(ren)			0.294
No	6 (7.1)	1 (20.0)	
Yes	79 (92.9)	4 (80.0)	
Coffee			0.403
No	142 (71.7)	4 (57.1)	
Yes	56 (28.3)	3 (42.9)	
Tea			0.135
No	85 (42.9)	5 (71.4)	

Yes	113 (57.1)	2 (28.6)	
Cola			0.991
No	170 (85.9)	6 (85.7)	
Yes	28 (14.1)	1 (14.3)	
POM			0.539
No	135 (68.2)	4 (57.1)	
Yes	63 (31.8)	3 (42.9)	
OTC			0.008
No	101 (51.0)	0 (0.0)	
Yes	97 (49.0)	7 (100.0)	
CAM			0.892
No	90 (45.5)	3 (42.9)	
Yes	108 (54.5)	4 (57.1)	
Alcohol			0.894
No	166 (83.8)	6 (85.7)	
Yes	32 (16.2)	1 (14.3)	
Cigarette			0.640
No	192 (97.0)	7 (100.0)	
Yes	6 (3.0)	0 (0.0)	
POM + OTC			0.312
No	169 (85.4)	5 (71.4)	
Yes	29 (14.6)	2 (28.6)	
POM + CAM			0.361
No	167 (84.3)	5 (71.4)	
Yes	31 (15.7)	2 (28.6)	
OTC + CAM			0.001
No	145 (73.2)	1 (14.3)	
Yes	53 (26.8)	6 (85.7)	
POM+OTC+CAM			0.037
No	184 (92.9)	5 (71.4)	
Yes	14 (7.1)	2 (28.6)	
POM + Alcohol			0.613
No	191 (96.5)	7 (100.0)	
Yes	7 (3.5)	0 (0.0)	
POM + Cigarette			0.789
No	196 (99.0)	7 (100.0)	
Yes	2 (1.0)	0 (0.0)	

POM+OTC+Alcohol			0.704
No	194 (98.0)	7 (100.0)	
Yes	4 (2.0)	0 (0.0)	
POM+OTC+Cigarette			0.850
No	197 (99.5)	7 (100.0)	
Yes	1 (0.5)	0 (0.0)	
POM+CAM+Alcohol			0.743
No	195 (98.5)	7 (100.0)	
Yes	3 (1.5)	0 (0.0)	
OTC + Alcohol			0.757
No	177 (89.4)	6 (85.7)	
Yes	21 (10.6)	1 (14.3)	
OTC+Cigarette			0.789
No	196 (99.0)	7 (100.0)	
Yes	2 (1.0)	0 (0.0)	
OTC+CAM+Alcohol			0.426
No	185 (93.4)	6 (85.7)	
Yes	13 (6.6)	1 (14.3)	
OTC+CAM+Cigarette			0.850
No	197 (99.5)	7 (100.0)	
Yes	1 (0.5)	0 (0.0)	
CAM + Alcohol			0.681
No	179 (90.4)	6 (85.7)	
Yes	19 (9.6)	1 (14.3)	
CAM + Cigarette			0.850
No	197 (99.5)	7 (100.0)	
Yes	1 (0.5)	0 (0.0)	
POM + OTC + CAM + Alcohol			0.789
No	196 (99.0)	7 (100.0)	
Yes	2 (1.0)	0 (0.0)	

Univariate associations between use of medicines and recreational substances in at least one trimester and preterm birth

	Preterm birth		
Variable	**No**	**Yes**	***p* value**
	n (%)	**n (%)**	
Age *(years)*			0.041
≤ 20	4 (2.1)	1 (7.1)	
21 – 30	50 (26.5)	8 (57.1)	
31 – 40	125 (66.1)	5 (35.7)	
41 – 50	10 (5.3)	0 (0.0)	
Ethnic Origin			0.036
White	142 (75.1)	7 (50.0)	
Black origin	13 (6.9)	1 (7.1)	
Asian	13 (6.9)	4 (28.6)	
Other	21 (11.1)	2 (14.3)	
Educational status			0.034
Below university qualification	36 (19.0)	6 (42.9)	
University qualification	153 (81.0)	8 (57.1)	
Gravidity			0.664
1	70 (37.0)	6 (42.9)	
≥ 2	119 (63.0)	8 (57.1)	
Previous obstetric problems			0.238
No	49 (41.2)	5 (62.5)	
Yes	70 (58.8)	3 (37.5)	
Parity			0.630
0	107 (56.6)	7 (50.0)	
≥ 1	82 (43.4)	7 (50.0)	
Previous healthy child(ren)			0.034
No	5 (6.1)	2 (28.6)	
Yes	77 (93.9)	5 (71.4)	
Coffee			0.514
No	133 (70.4)	11 (78.6)	
Yes	56 (29.6)	3 (21.4)	
Tea			0.939
No	83 (43.9)	6 (42.9)	

Yes	106 (56.1)	8 (57.1)	
Cola			0.018
No	165 (87.3)	9 (64.3)	
Yes	24 (12.7)	5 (35.7)	
POM			0.135
No	131 (69.3)	7 (50.0)	
Yes	58 (30.7)	7 (50.0)	
OTC			0.100
No	92 (48.7)	10 (71.4)	
Yes	97 (51.3)	4 (28.6)	
CAM			0.337
No	83 (43.9)	8 (57.1)	
Yes	106 (56.1)	6 (42.9)	
Alcohol			0.836
No	158 (83.6)	12 (85.7)	
Yes	31 (16.4)	2 (14.3)	
Cigarette			0.499
No	183 (96.8)	14 (100.0)	
Yes	6 (3.2)	0 (0.0)	
POM + OTC			0.404
No	160 (84.7)	13 (92.9)	
Yes	29 (15.3)	1 (7.1)	
POM + CAM			0.587
No	159 (84.1)	11 (78.6)	
Yes	30 (15.9)	3 (21.4)	
OTC + CAM			0.234
No	134 (70.9)	12 (85.7)	
Yes	55 (29.1)	2 (14.3)	
POM+OTC+CAM			0.257
No	173 (91.5)	14 (100.0)	
Yes	16 (8.5)	0 (0.0)	
POM + Alcohol			0.432
No	183 (96.8)	13 (92.9)	
Yes	6 (3.2)	1 (7.1)	
POM + Cigarette			0.699
No	187 (98.9)	14 (100.0)	
Yes	2 (1.1)	0 (0.0)	

POM+OTC+Alcohol			0.582
No	185 (97.9)	14 (100.0)	
Yes	4 (2.1)	0 (0.0)	
POM+OTC+Cigarette			0.785
No	188 (99.5)	14 (100.0)	
Yes	1 (0.5)	0 (0.0)	
POM+CAM+Alcohol			0.635
No	186 (98.4)	14 (100.0)	
Yes	3 (1.6)	0 (0.0)	
OTC + Alcohol			0.176
No	167 (88.4)	14 (100.0)	
Yes	22 (11.6)	0 (0.0)	
OTC+Cigarette			0.699
No	187 (98.9)	14 (100.0)	
Yes	2 (1.1)	0 (0.0)	
OTC+CAM+Alcohol			0.291
No	175 (92.6)	14 (100.0)	
Yes	14 (7.4)	0 (0.0)	
OTC+CAM+Cigarette			0.785
No	188 (99.5)	14 (100.0)	
Yes	1 (0.5)	0 (0.0)	
CAM + Alcohol			0.200
No	169 (89.4)	14 (100.0)	
Yes	20 (10.6)	0 (0.0)	
CAM + Cigarette			0.785
No	188 (99.5)	14 (100.0)	
Yes	1 (0.5)	0 (0.0)	
POM + OTC + CAM + Alcohol			0.699
No	187 (98.9)	14 (100.0)	
Yes	2 (1.1)	0 (0.0)	

Univariate associations between use of medicines and recreational substances in at least one trimester and low birth weight

Variable	Low birth weight No	Yes	*p* value
	n (%)	n (%)	
Age *(years)*			0.037
≤ 20	4 (2.1)	1 (10.0)	
21 – 30	52 (26.9)	6 (60.0)	
31 – 40	127 (65.8)	3 (30.0)	
41 – 50	10 (5.2)	0 (0.0)	
Ethnic Origin			<0.0001
White	145 (75.1)	4 (40.0)	
Black origin	14 (7.3)	0 (0.0)	
Asian	12 (6.2)	5 (50.0)	
Other	22 (11.4)	1 (10.0)	
Educational status			0.122
Below university qualification	38 (19.7)	4 (40.0)	
University qualification	155 (80.3)	6 (60.0)	
Gravidity			0.131
1	70 (36.3)	6 (60.0)	
≥ 2	123 (63.7)	4 (40.0)	
Previous obstetric problems			0.758
No	52 (42.3)	2 (50.0)	
Yes	71 (57.7)	2 (50.0)	
Parity			0.119
0	106 (54.9)	8 (80.0)	
≥ 1	87 (45.1)	2 (20.0)	
Previous healthy child(ren)			0.676
No	7 (8.0)	0 (0.0)	
Yes	80 (92.0)	2 (100.0)	
Coffee			0.517
No	136 (70.5)	8 (80.0)	
Yes	57 (29.5)	2 (20.0)	
Tea			0.802
No	85 (44.0)	4 (40.0)	

Yes	108 (56.0)	6 (60.0)	
Cola			0.596
No	166 (86.0)	8 (80.0)	
Yes	27 (14.0)	2 (20.0)	
POM			0.579
No	132 (68.4)	6 (60.0)	
Yes	61 (31.6)	4 (40.0)	
OTC			0.200
No	95 (49.2)	7 (70.0)	
Yes	98 (50.8)	3 (30.0)	
CAM			0.322
No	85 (44.0)	6 (60.0)	
Yes	108 (56.0)	4 (40.0)	
Alcohol			0.742
No	162 (83.9)	8 (80.0)	
Yes	31 (16.1)	2 (20.0)	
Cigarette			0.571
No	187 (96.9)	10 (100.0)	
Yes	6 (3.1)	0 (0.0)	
POM + OTC			0.662
No	164 (85.0)	9 (90.0)	
Yes	29 (15.0)	1 (10.0)	
POM + CAM			0.742
No	162 (83.9)	8 (80.0)	
Yes	31 (16.1)	2 (20.0)	
OTC + CAM			0.560
No	138 (71.5)	8 (80.0)	
Yes	55 (28.5)	2 (20.0)	
POM+OTC+CAM			0.799
No	178 (92.2)	9 (90.0)	
Yes	15 (7.8)	1 (10.0)	
POM + Alcohol			0.244
No	187 (96.9)	9 (90.0)	
Yes	6 (3.1)	1 (10.0)	
POM + Cigarette			0.746
No	191 (99.0)	10 (100.0)	
Yes	2 (1.0)	0 (0.0)	

POM+OTC+Alcohol			0.646
No	189 (97.9)	10 (100.0)	
Yes	4 (2.1)	0 (0.0)	
POM+OTC+Cigarette			0.819
No	192 (99.5)	10 (100.0)	
Yes	1 (0.5)	0 (0.0)	
POM+CAM+Alcohol			0.691
No	190 (98.4)	10 (100.0)	
Yes	3 (1.6)	0 (0.0)	
OTC + Alcohol			0.258
No	171 (88.6)	10 (100.0)	
Yes	22 (11.4)	0 (0.0)	
OTC+Cigarette			0.746
No	191 (99.0)	10 (100.0)	
Yes	2 (1.0)	0 (0.0)	
OTC+CAM+Alcohol			0.377
No	179 (92.7)	10 (100.0)	
Yes	14 (7.3)	0 (0.0)	
OTC+CAM+Cigarette			0.819
No	192 (99.5)	10 (100.0)	
Yes	1 (0.5)	0 (0.0)	
CAM + Alcohol			0.284
No	173 (89.6)	10 (100.0)	
Yes	20 (10.4)	0 (0.0)	
CAM + Cigarette			0.819
No	192 (99.5)	10 (100.0)	
Yes	1 (0.5)	0 (0.0)	
POM + OTC + CAM + Alcohol			0.746
No	191 (99.0)	10 (100.0)	
Yes	2 (1.0)	0 (0.0)	

Univariate associations between use of medicines and recreational substances in at least one trimester and admission to NNU

Variable	Admission to NNU No	Yes	*p* value
	n (%)	n (%)	
Age *(years)*			0.220
≤ 20	4 (2.2)	2 (8.3)	
21 – 30	50 (27.6)	8 (33.3)	
31 – 40	117 (64.6)	14 (58.3)	
41 – 50	10 (5.5)	0 (0.0)	
Ethnic Origin			0.264
White	137 (75.7)	14 (58.3)	
Black origin	12 (6.6)	2 (8.3)	
Asian	13 (7.2)	4 (16.7)	
Other	19 (10.5)	4 (16.7)	
Educational status			0.294
Below university qualification	36 (19.9)	7 (29.2)	
University qualification	145 (80.1)	17 (70.8)	
Gravidity			0.181
1	65 (35.9)	12 (50.0)	
≥ 2	116 (64.1)	12 (50.0)	
Previous obstetric problems			0.565
No	48 (41.4)	6 (50.0)	
Yes	68 (58.6)	6 (50.0)	
Parity			0.267
0	99 (54.7)	16 (66.7)	
≥ 1	82 (45.3)	8 (33.3)	
Previous healthy child(ren)			0.389
No	7 (8.5)	0 (0.0)	
Yes	75 (91.5)	8 (100.0)	
Coffee			0.663
No	128 (70.7)	18 (75.0)	
Yes	53 (29.3)	6 (25.0)	
Tea			0.522
No	78 (43.1)	12 (50.0)	

Yes	103 (56.9)	12 (50.0)	
Cola			0.805
No	155 (85.6)	21 (87.5)	
Yes	26 (14.4)	3 (12.5)	
POM			0.205
No	120 (66.3)	19 (79.2)	
Yes	61 (33.7)	5 (20.8)	
OTC			0.399
No	89 (49.2)	14 (58.3)	
Yes	92 (50.8)	10 (41.7)	
CAM			0.698
No	83 (45.9)	10 (41.7)	
Yes	98 (54.1)	14 (58.3)	
Alcohol			0.610
No	151 (83.4)	21 (87.5)	
Yes	30 (16.6)	3 (12.5)	
Cigarette			0.701
No	176 (97.2)	23 (95.8)	
Yes	5 (2.8)	1 (4.2)	
POM + OTC			0.111
No	151 (83.4)	23 (95.8)	
Yes	30 (16.6)	1 (4.2)	
POM + CAM			0.610
No	151 (83.4)	21 (87.5)	
Yes	30 (16.6)	3 (12.5)	
OTC + CAM			0.874
No	131 (72.4)	17 (70.8)	
Yes	50 (27.6)	7 (29.2)	
POM+OTC+CAM			0.479
No	166 (91.7)	23 (95.8)	
Yes	15 (8.3)	1 (4.2)	
POM + Alcohol			0.829
No	175 (96.7)	23 (95.8)	
Yes	6 (3.3)	1 (4.2)	
POM + Cigarette			0.605
No	179 (98.9)	24 (100.0)	
Yes	2 (1.1)	0 (0.0)	

POM+OTC+Alcohol			0.462
No	177 (97.8)	24 (100.0)	
Yes	4 (2.2)	0 (0.0)	
POM+OTC+Cigarette			0.715
No	180 (99.4)	24 (100.0)	
Yes	1 (0.6)	0 (0.0)	
POM+CAM+Alcohol			0.525
No	178 (98.3)	24 (100.0)	
Yes	3 (1.7)	0 (0.0)	
OTC + Alcohol			0.269
No	160 (88.4)	23 (95.8)	
Yes	21 (11.6)	1 (4.2)	
OTC+Cigarette			0.091
No	180 (99.4)	23 (95.8)	
Yes	1 (0.6)	1 (4.2)	
OTC+CAM+Alcohol			0.158
No	167 (92.3)	24 (100.0)	
Yes	14 (7.7)	0 (0.0)	
OTC+CAM+Cigarette			0.006
No	181 (100.0)	23 (95.8)	
Yes	0 (0.0)	1 (4.2)	
CAM + Alcohol			0.086
No	161 (89.0)	24 (100.0)	
Yes	20 (11.0)	0 (0.0)	
CAM + Cigarette			0.006
No	181 (100.0)	23 (95.8)	
Yes	0 (0.0)	1 (4.2)	
POM + OTC + CAM + Alcohol			0.605
No	179 (98.9)	24 (100.0)	
Yes	2 (1.1)	0 (0.0)	

Univariate associations between use of medicines and recreational substances in at least one trimester and other problems

	Other problems		
Variable	**No**	**Yes**	***p* value**
	n (%)	**n (%)**	
Age *(years)*			0.633
≤ 20	4 (2.3)	2 (6.1)	
21 – 30	48 (27.9)	10 (30.3)	
31 – 40	111 (64.5)	20 (60.6)	
41 – 50	9 (5.2)	1 (3.0)	
Ethnic Origin			0.669
White	124 (72.1)	27 (81.8)	
Black origin	12 (7.0)	2 (6.1)	
Asian	15 (8.7)	2 (6.1)	
Other	21 (12.2)	2 (6.1)	
Educational status			0.667
Below university qualification	37 (21.5)	6 (18.2)	
University qualification	135 (78.5)	27 (81.8)	
Gravidity			0.812
1	64 (37.2)	13 (39.4)	
≥ 2	108 (62.8)	20 (60.6)	
Previous obstetric problems			0.007
No	51 (47.2)	3 (15.0)	
Yes	57 (52.8)	17 (85.0)	
Parity			0.341
0	94 (54.7)	21 (63.6)	
≥ 1	78 (45.3)	12 (36.4)	
Previous healthy child(ren)			0.280
No	7 (9.0)	0 (0.0)	
Yes	71 (91.0)	12 (100.0)	
Coffee			0.059
No	118 (68.6)	28 (84.8)	
Yes	54 (31.4)	5 (15.2)	
Tea			0.182
No	79 (45.9)	11 (33.3)	

Yes	93 (54.1)	22 (66.7)	
Cola			0.363
No	146 (84.9)	30 (90.9)	
Yes	26 (15.1)	3 (9.1)	
POM			0.170
No	120 (69.8)	19 (57.6)	
Yes	52 (30.2)	14 (42.4)	
OTC			0.358
No	84 (48.8)	19 (57.6)	
Yes	88 (51.2)	14 (42.4)	
CAM			0.248
No	75 (43.6)	18 (54.5)	
Yes	97 (56.4)	15 (45.5)	
Alcohol			0.872
No	144 (83.7)	28 (84.8)	
Yes	28 (16.3)	5 (15.2)	
Cigarette			0.022
No	169 (98.3)	30 (90.9)	
Yes	3 (1.7)	3 (9.1)	
POM + OTC			0.033
No	150 (87.2)	24 (72.7)	
Yes	22 (12.8)	9 (27.3)	
POM + CAM			0.722
No	145 (84.3)	27 (81.8)	
Yes	27 (15.7)	6 (18.2)	
OTC + CAM			0.941
No	124 (72.1)	24 (72.7)	
Yes	48 (27.9)	9 (27.3)	
POM+OTC+CAM			0.313
No	160 (93.0)	29 (87.9)	
Yes	12 (7.0)	4 (12.1)	
POM + Alcohol			0.361
No	167 (97.1)	31 (93.9)	
Yes	5 (2.9)	2 (6.1)	
POM + Cigarette			0.190
No	171 (99.4)	32 (97.0)	
Yes	1 (0.6)	1 (3.0)	

POM+OTC+Alcohol			0.625
No	169 (98.3)	32 (97.0)	
Yes	3 (1.7)	1 (3.0)	
POM+OTC+Cigarette			0.022
No	172 (100.0)	32 (97.0)	
Yes	0 (0.0)	1 (3.0)	
POM+CAM+Alcohol			0.445
No	169 (98.3)	33 (100.0)	
Yes	3 (1.7)	0 (0.0)	
OTC + Alcohol			0.740
No	153 (89.0)	30 (90.9)	
Yes	19 (11.0)	3 (9.1)	
OTC+Cigarette			0.190
No	171 (99.4)	32 (97.0)	
Yes	1 (0.6)	1 (3.0)	
OTC+CAM+Alcohol			0.848
No	160 (93.0)	31 (93.9)	
Yes	12 (7.0)	2 (6.1)	
OTC+CAM+Cigarette			0.661
No	171 (99.4)	33 (100.0)	
Yes	1 (0.6)	0 (0.0)	
CAM + Alcohol			0.435
No	154 (89.5)	31 (93.9)	
Yes	18 (10.5)	2 (6.1)	
CAM + Cigarette			0.661
No	171 (99.4)	33 (100.0)	
Yes	1 (0.6)	0 (0.0)	
POM + OTC + CAM + Alcohol			0.534
No	170 (98.8)	33 (100.0)	
Yes	2 (1.2)	0 (0.0)	

Appendix 7 – Comparison of first, second and third trimester use of medicines or recreational substances using the chi-square test

Medicine/Substance	Trimesters (*p* values) 1st and 2nd	2nd and 3rd	1st and 3rd
Prescription medicines	<0.0001	<0.0001	<0.0001
Over-the-counter medicines	<0.0001	<0.0001	<0.0001
Complementary and alternative medicines	<0.0001	<0.0001	<0.0001
Alcohol	<0.0001	<0.0001	<0.0001
Cigarette	<0.0001	<0.0001	<0.0001

Appendix 8 – Interview guide for the qualitative study (Final version)

INTERVIEW GUIDE

Preamble: I am the research pharmacist at the hospital. Following your participation in the first part of our study on ***Medicine and recreational substance use in pregnancy***, I would like to carry out a 30-minute interview with you. The purpose of this interview is to find out your beliefs and views on the use of medicines and recreational substances during pregnancy. We would also be grateful if you could share your experiences of the medicines or substances you have used.

All responses are confidential and anonymous.

General Questions

1. **How often do you think about your health in pregnancy?**
   (What are the things you think about?)

2. **Do you have any concerns about your health?**

3. **Do you have any concerns about the health of your unborn baby?**

Prescription medicines

1. **As regards your medicines, can you tell me what you know about them?**
   (Safety information; sources of information e.g. GP, midwife/consultant, pharmacist, books, internet, friends/family, other sources; other discussions/advice received with the medicines from doctor/midwife/other health professional; anything else…)

2. **How do you take your medicines?**
   (The dose, frequency and duration of use)

3. **Do you remember how it was prescribed?**

4. **Can you tell me what your experience has been as regards taking your regular medicines every day?**
   (Your thoughts on missed doses)

5. **What do you know about the benefits of taking these medicines during pregnancy?**

6. **What do you know about the risks of not taking these medicines during pregnancy?**

Over-the-counter medicines

1. **As regards your over-the-counter medications, can you tell me what you know about them?**
   (Safety information; sources of information e.g. GP, midwife/consultant, pharmacist, books, internet, friends/family, other sources; other discussions/advice received with the medicines from doctor/midwife/other health professional; anything else…)

2. **How do you take the medicines?**
   (The dose, frequency and duration of use)

3. **Do you remember how it was recommended?**

4. **Can you tell me what your experience has been as regards taking your regular medicines every day?**
   (Your thoughts on missed doses)

5. **What do you know about the benefits of taking these medicines during pregnancy?**

6. **What do you know about the risks of not taking these medicines during pregnancy?**

Complementary and Alternative Medicines (CAM)

1. **You mentioned in the questionnaire that you are using CAM, can you tell me more about it?**
   (Why you decided to use it; the source e.g. therapist/practitioner, friends/family, internet, other sources; safety information; other discussions/advice received with the CAM; anything else…)

2. **What do you know about the benefits of taking the CAM during pregnancy?**

3. **What do you know about the risks of taking the CAM during pregnancy?**

4. **Have you spoken to your midwife/doctor about your CAM use?**
   (Midwife/doctor's comments)

5. **Based on your experience, will you recommend the CAM to another pregnant woman?**

Recreational Substances (cigarette, alcohol and cannabis)

1. **In the questionnaire, you talked about using cigarette/alcohol/cannabis, can you tell me more about your reasons for using it in pregnancy?**
   (Frequency of use during pregnancy; does the partner/spouse or friends/family drink or smoke?)

2. **Can you tell me the information you have about the cigarette/alcohol/cannabis?**
   (Safety information; belief in safety limits; sources of information e.g. GP, midwife/consultant, pharmacist, books, internet, friends/family, other sources; other discussions/advice received from doctor/midwife/other health professional; anything else…)

3. **What do you know about the risks of taking cigarette/alcohol/cannabis during pregnancy?**

4. **Are you interested in stopping cigarette/alcohol/cannabis during your pregnancy?**
   (Have you tried stopping? What are the things you feel you can do to help you stop?)

Do you have any other thoughts or experiences about the use of medicines and substances in pregnancy that you would like to share?

Thank you very much for your time.

Appendix 9 – The coding framework for the qualitative study

Main Codes	Sub codes
1. Thinking of health	1.1 Quite often/All the time 1.2 Sometimes
2. Concerns/worries about health	2.1 Yes 2.1.1 High blood pressure 2.1.2 Enough vitamins/minerals 2.1.3 Enough water 2.1.4 Bleeding/Spotting 2.1.5 Positive fibronectin test 2.1.6 Low-lying placenta 2.1.7 Diabetes 2.1.8 Rare blood type 2.1.9 Fibroid pain, contractions 2.1.10 Fatigue 2.1.11 Weight gain 2.2 No concerns
3. Concerns about unborn baby's health	3.1 Yes 3.1.1 Preterm delivery 3.1.2 Neonatal complications 3.1.3 Baby's heart beat/breathing problems 3.1.4 Large abdominal circumference 3.1.5 Food intake 3.2 No concerns 3.2.1 Regular check-ups 3.2.2 Low risk 3.2.3 Scan and test results 3.2.4 Foetal movements
4. Prescription medicines	4.1 Sources of information 4.1.1 GP 4.1.2 Midwife 4.1.3 Pharmacist 4.1.4 Internet 4.1.5 Product leaflets 4.1.6 Books 4.2 Adherence issues 4.2.1 Medicine taken or used as prescribed 4.2.2 Thoughts on missed doses 4.2.2.1 On and off the medicine/medicine used anytime

	4.2.2.2 Non-adherence due to lack of conviction about diagnosis 4.2.2.3 Non-adherence due to high dosage perception 4.2.2.4 Non-adherence due to side effects 4.2.2.5 Non-adherence due to forgetfulness 4.2.2.6 Non-adherence due to perception that iron is not low 4.2.2.7 Supplementing with fruits 4.3 Experiences of medicine use 4.3.1 Fine 4.3.2 Side effects experience 4.3.3 None 4.4 Benefits of using medicine 4.4.1 Control of nausea 4.4.2 Gets rid of UTI 4.4.3 Lowering blood sugar 4.4.4 Boosting iron or blood level 4.4.5 Relieves aches and pains 4.4.6 Controls heartburn and indigestion 4.4.7 Gets rid of infections 4.4.8 No information on benefits 4.5 Risks of not using medicine 4.5.1 Dehydration 4.5.2 Inadequate vitamins 4.5.3 Inadequate care for self and family 4.5.4 Symptoms would not improve or infection gets worse 4.5.5 Blood sugar getting high 4.5.6 Activity levels becoming affected 4.5.7 Low blood level or fainting 4.5.8 No information on risks
5. Over-the-counter medicines (Vitamins)	5.1 Recommended 5.1.1 By Midwife 5.1.2 By GP 5.1.3 Friends/Family 5.1.4 Self-decision

	5.1.5 Other sources of information (Internet, product leaflets) 5.2 Adherence issues 5.2.1 Vitamins taken as recommended 5.2.2 Thoughts on missed doses 5.2.2.1 Non-adherence to forgetfulness 5.2.2.2 Non-adherence due to sickness 5.2.2.3 Not good at taking medicines 5.2.2.4 Running out of medicine 5.2.2.5 Big tablets 5.2.2.6 Just a supplement 5.3 Experiences of vitamin use 5.3.1 Fine/Good 5.3.2 No bad effects 5.3.3 None 5.4 Benefits of using vitamins 5.4.1 Supplements food 5.4.2 Feeling healthier/better 5.4.3 Good for baby development 5.4.4 Not sure of the effects 5.5 Risks of not using vitamins 5.5.1 Spina bifida/spinal defects 5.5.2 Cleft lip 5.5.3 Inadequate calcium and vitamins for baby 5.5.4 Rickets 5.5.5 Inadequate development of the baby 5.5.6 Don't know the risks 5.5.7 Don't believe in risks
6. Complementary and alternative medicines (CAM)	6.1 Recommended 6.1.1 By Friends/Family 6.1.2 By midwife 6.1.3 By CAM practitioner 6.1.4 Other sources of information (Internet, product leaflets) 6.2 Indications/Reasons for use

	6.3 Benefits of using CAM 6.3.1 Yes 6.3.2 No 6.3.3 Not sure/Uncertain 6.4 Risks of using CAM 6.4.1 Natural 6.4.2 No risks 6.4.3 Not harmful/dangerous 6.5 Discussion with healthcare professionals 6.5.1 Yes 6.5.2 No because it was not important 6.5.3 No because of time constraints 6.6 Recommending CAM 6.6.1 Yes 6.6.2 No 6.6.3 Not sure
7. Alcohol	7.1 Taking 1-2 units per week 7.2 Liking for alcohol 7.3 It is relaxing 7.4 Friends/family consumption 7.5 Small intake (1-2 units) won't hurt baby 7.6 Large amount can hurt baby 7.7 Fine in moderation 7.8 Paranoid about smoking 7.9 Smoking is worse 7.10 Sources of information 7.10.1 Healthcare professionals 7.10.2 Friends/Family 7.10.3 Internet 7.10.4 Media 7.10.5 Pregnancy book 7.11 Discussion with healthcare professionals 7.11.1 Yes but did not admit consumption 7.11.2 Yes and admitted consumption
8. Cigarette	8.1 Smoking for long 8.2 Finding it hard to stop

	8.3 Cut down in pregnancy 8.4 Referral to stop smoking clinic 8.5 Use of nicotine patches 8.6 Ineffectiveness of patches 8.7 Risk to the baby 8.8 Partner's consumption
9. Cannabis	9.1 Consumed once a month 9.2 Reduced intake in pregnancy 9.3 For creative inspiration 9.4 Does not consume much 9.5 Partner's consumption 9.6 No knowledge of risks
10. Other thoughts/experiences	10.1 Trust in healthcare professionals 10.2 Trust in CAM practitioners 10.3 Preference for homeopathic labour induction 10.4 Researching for information about medicines 10.5 Seeking medical advice 10.6 Eating healthily and on time 10.7 Taking things in moderation is fine