Chapter 1: General Introduction
General Introduction

1. Background

In this thesis, various studies are presented investigating women’s health and health behaviours during pregnancy and prenatal health education provided by midwives in primary care. This chapter starts with some background information to the research presented in this thesis and provides an overview of the structure of this thesis, including its main objectives.

The life-long health of individuals is influenced by biological factors (hereditary or acquired), physical factors (such as climate, chemicals and viruses/bacteria), social environment (such as family income, social networks and housing conditions) and political/health care systems (including policies and facilities to cure disease/promote health) and health behaviours, as well as the interactions of these factors [1]. Many of these factors already influence the health of individuals before they are born and even conceived [2, 3]. Although many risk factors for adverse birth outcomes are beyond the potential control of mothers, there is increasing evidence that the health and health behaviours of mothers during pregnancy have an impact on the physical and cognitive health of their children. This evidence is promising, as many health factors are at least somewhat modifiable, giving potential for improving the health of individuals throughout their lives. Pregnancy is therefore considered to be a window of opportunity for promoting the health of mothers and their children. Despite the potential for health gain, however, people do not have complete control over their own health and health behaviours [4, 5]. This justifies the need for pro-active health promotion by health care providers to help empower (motivate and enable) people to make health-promoting lifestyle changes. During the first International Conference on Health Promotion in Ottawa (World Health Organization, 1986), health promotion was described as ‘the process of enabling individuals and communities to increase control over, and to improve their health’ [6].

Primary care midwives also play an important role in promoting practices in pregnant women that contribute to health promotion and disease prevention during pregnancy and beyond. In the Netherlands, 86% of all pregnant women start their pregnancy in primary care under the care of midwives (data from 2014) [7]. If pregnancy complications arise, such as pre-eclampsia, women are referred to secondary obstetrician-led care (35.4%) [7]. Women who already have risks for pregnancy complications, such as diabetes, at the start of their pregnancy, will begin their pregnancy in secondary prenatal care [8]. One of the tasks given to midwives is to provide health education to pregnant women to help improve the chances of a healthy pregnancy, mother and child [9].
In order to provide good health education and implement effective health promotion interventions, it is important to know what the health status is and health behaviours are of pregnant women, as well as the factors which may influence, or at least are associated with these health indicators. It is also important to examine the health education that is currently provided by midwives to pregnant women, to determine whether there is room for improvement. The studies in this thesis therefore have two central objectives: the first objective is to investigate maternal/perinatal health and health behaviours in pregnant women in primary midwife-led care in the Netherlands, as well as maternal characteristics associated with these health indicators. The second objective is to examine the prenatal health education that is currently provided by midwives to pregnant women in primary care.

2. Model for planned health education and promotion

As advised by different models and frameworks for planned health promotion and disease prevention, the development and implementation of effective interventions aimed at preventing or reducing adverse health issues, should be informed by thorough analyses of health and disease, relevant risk factors and determinants of exposure to such risk factors. One such framework recommended for planning health interventions is the Model for Planned Health Education and Promotion [10] (See figure 1), which is based on other similar models such as the PRECEDE/PROCEED model[11]. It involves five inter-related steps from analyzing the specific health issues to implementing interventions directed at preventing or reducing these health issues, with each step requiring an evaluation to maximize the chances of beneficial results.

The first step is to gain a clear picture of the health issue at hand, by analyzing its prevalence and seriousness, based on its associated morbidity, mortality, and quality of life. Once it is clear that it is a problem worth addressing, the second step involves analyzing the behavioural risk factors associated with the health issue. After establishing which risk factors are involved, it is important to analyze the personal determinants (such as knowledge, attitudes and self-efficacy) and environmental determinants (physical, socio-cultural, economic and political) of these behavioural risk factors in step three. This analysis of determinants should be guided and informed by health behaviour theories, such as social-cognitive models with a strong focus on personal motivational and enabling factors, socio-ecological models with a strong focus on contextual drivers of health behaviours, models that combine these two approaches and models that focus more strongly on guiding health behaviour change. Those working in health promotion can then address these determinants of risk factors in the development, implementation
Figure 1. Model for planned health education and promotion (Brug et al., 2012)

In this thesis, we contribute to the first steps of the model which are required to plan and implement interventions in prenatal health promotion. We also evaluate a health promotional intervention currently in place, which is the prenatal health education provided by midwives to women during pregnancy. This model is used as a framework in which to structure the research performed in this thesis.

2.1. Analysis of health and quality of life: birth outcomes and chronic diseases

The first step in the Model for Planned Health Education and Promotion involves the analysis of birth outcomes and chronic diseases. The most common adverse birth outcomes are preterm birth, low birth weight, small for gestational age, congenital defects and still-birth. Preterm birth is the leading birth outcome associated with perinatal morbidity and mortality, and the focus of one of the studies in this thesis. Maternal suboptimal health and health behaviours during pregnancy as well as adverse birth outcomes are associated with mortality, chronic diseases, obesity and cognitive disabilities in later life in their offspring.
Preterm birth

Preterm birth, defined as birth at the gestational age of shorter than 37 weeks, is the leading type of adverse birth outcome. Three different types of preterm birth have been defined: spontaneous preterm labour (accounting for 40-45% of all preterm births), birth following premature rupture of the membranes (PPROM) (25-30% of all preterm births) and preterm labour induction or caesarean section (20-25% of all preterm births) [12]. The first two preterm types are often grouped into the spontaneous preterm birth category. The last preterm type refers to elective preterm birth due to maternal or infant health conditions, such as pre-eclampsia or fetal growth restriction [13].

It has been estimated that the preterm birth rate globally is 11.1% of all births, with the highest rates occurring in Africa (18%) and the lowest rates occurring in Europe (5%) [14]. In the Netherlands, preterm birth was estimated to be 7.3% in 2014 [7]. The rates of preterm birth are increasing in many industrialized countries, despite the advances in medical interventions. This is thought to be due to complications associated with obesity, such as pre-eclampsia and hypertension, as well as with reproductive technologies, both of which are on the rise [15].

Consequences of preterm birth

Preterm birth can be associated with an already present adverse condition in the womb, such as intra-uterine growth restriction [16], but also presents as a risk factor itself for suboptimal health conditions in both mother and child. Advances in neonatal care are enabling more and more premature children to survive than before, but these children are more likely to have long-term adverse mental and physical health, such as learning difficulties in school [17] and chronic diseases, such as diabetes and cardiovascular diseases [18]. About 75% of stillbirth is associated with preterm birth [12].

There is evidence that women who have given birth prematurely also have a greater chance of developing cardiovascular disease themselves in later life, suggesting that preterm births and cardiovascular disease share some of the same biological mechanisms and possibly the same risk factors [19, 20].

Potentially preventable chronic diseases

The last decades have seen an increase around the world in chronic diseases (cardiovascular disease, cancer, respiratory disease and diabetes), 80% of which are considered to be preventable, or of which the onset at least can be delayed [3]. Although there are many factors throughout life that contribute to this rise in chronic diseases, more animal and human studies are showing that their roots may appear before birth, and even before conception [2, 21, 22]. Barker was the first to describe this association in his theory of Fetal Origins of Adult Disease [23], when he found that children who had been exposed to malnutrition in utero, were more likely to have cardiovascular...
disease later in life. He theorized that the genes of an individual are programmed to adjust to the circumstances in the intra-uterine environment and this programming is lasting, having an impact on the person’s health for the rest of their life. One well-known illustrative example is from research done on individuals born in Amsterdam during the Dutch famine from November 1944 till May 1945 known as the Hongerwinter (Hunger winter) (www.hongerwinter.nl). Many infants who were conceived and born during that period had experienced undernutrition while in the womb, as the official daily rations were between 400 and 800 calories. As adults, these individuals are more likely to be overweight, have diabetes and cardiovascular diseases, cancer, depression and stress [24]. The children of these individuals are also more likely to develop similar conditions. Some authors have argued that influencing the early adverse exposures to the foetus, such as poor nutrition, tobacco and alcohol, may be the best way to interrupt the cycle and curb the increasing prevalence of chronic diseases [25].

**Costs of preterm birth and chronic diseases**

The costs associated with preterm births alone are substantial. A recent Dutch study, for instance, calculated the mean costs for one preterm birth at 24 weeks to be €88,052, at 30 weeks €34,510 and at 34 weeks €11,222 compared to a mean of €1,434 per full term birth [26]. A United States estimation of annual preterm birth costs was 26 billion dollars in 2005. These costs do not include the life-long expenses associated with preterm births, such as those of chronic diseases (IOM, 2007). The costs of chronic diseases are also substantial, costing an estimated 70% (i.e. €18 billion) of the total health care costs in the Netherlands in 2006 and 86% of the national health costs in the United States in 2010 [27, 28].

Decreasing the morbidity and mortality associated with adverse birth outcomes could potentially lead to a higher quality of life on many levels from mental and physical health and well-being to increased financial means, productivity and general economic development of populations. In order to help accomplish this, modifiable risk factors which are strongly related to these adverse outcomes need to be identified. In chapter 2 of this thesis, we examine the prevalence of spontaneous preterm birth in nulliparous women as well as investigate maternal health behavioural and psychological characteristics associated with spontaneous preterm birth.

### 2.2. Analysis of risk factors for adverse birth outcomes and long term ill-health

In the second step of the Model for Planned Health Education and Promotion, the risk factors for adverse birth outcomes and long-term ill-health are analysed. There are proximal and distal risk factors, which have been identified as being associated with adverse birth outcomes and long-term ill-health. Proximal risk factors, such as
suboptimal health behaviours, are more likely to be directly responsible for effects on adverse outcomes, whereas distal risk factors, such as socio-economic status, may be indirectly associated with adverse outcomes, through other risk factors [10]. The main proximal and distal risk factors that we examine in this thesis, are described below.

**Proximal risk factors**
While many risk factors are beyond the control of the mother, there is increasing evidence that maternal health behaviours, such as suboptimal nutrition, low physical activity, smoking and alcohol consumption may contribute to both short-term and long-term maternal and child ill-health. In this thesis we examine the prevalence of smoking, alcohol consumption, nutritional status as well as psychological characteristics in pregnant women in primary care and their associations with sociodemographic and other health behavioural characteristics (chapters 3 and 4).

**Nutrition and physical activity**
Healthy diets during pregnancy are associated with lower chances of adverse pregnancy outcomes and healthier children [29-33]. High fruit and vegetable consumption during pregnancy, for example, is associated with a reduced risk for pre-eclampsia [34] and with a reduced risk for preterm birth [35, 36]; adequate consumption of fatty fish during pregnancy is associated with reduced risk of preterm birth [37] and favourable neurological development in children [38]. Physical activity during pregnancy has been observed to be protective of gestational diabetes, excessive weight gain during pregnancy and preterm birth [39-41].

Some studies have found that most pregnant women do not meet the recommendations for fruit and vegetable consumption, even in high-income countries [42, 43]. While there is a reduction in smoking, alcohol and coffee consumption during pregnancy, fruit and vegetable consumption tends to remain the same before and during pregnancy [44]. Fish consumption and physical activity tend to decline during pregnancy [40, 45, 46]. In the general population of the Netherlands, fruit, vegetable and fish consumption as well as physical activity are already below recommended levels [47]. As much is unknown about the nutrition of pregnant women in the Netherlands, this thesis also examines daily fruit and vegetable consumption in pregnant women, as well as meal patterns (see chapter 3).

**Body Mass Index**
Women who start their pregnancy with overweight and obesity are more likely to develop pregnancy complications, such as diabetes, hypertension and pre-eclampsia, and more likely to have adverse birth outcomes, such as preterm birth and small-for-gestational age infants [48, 49]. A systematic review and meta-analysis examining the major modifiable risk factors for stillbirth in high-income countries concluded
that overweight was the highest ranking modifiable risk factor, followed by advanced maternal age (>35 years) and maternal smoking [50]. A prospective cohort study carried out in the multi-ethnic population of Amsterdam showed the population attribution fractions (PAF) of overweight for adverse birth outcomes to be 15.5% for large for gestational age (LGA), 6.6% for preterm birth (PTB) and 22% for extreme preterm birth [51]. These PAFs were higher than the PAFs for smoking.

Exposures to obesity during pregnancy can lead to leptin resistance (leptin regulates energy expenditure and modulates appetite), insulin resistance and glucose intolerance [52]. Lab controlled animal studies have shown similar effects. Female rats fed a high-fat diet during pregnancy are more likely to have offspring who become obese and are glucose intolerant [21]. The offspring of mothers with obesity are therefore also more likely to develop high blood pressure, obesity and diabetes, as some point in their lives. Overweight and obese women also have higher risks of having infants with neural tube defects and congenital heart disease [53]. The other BMI extreme, maternal underweight, is also associated with preterm birth and small-for-gestational-age [54].

**Smoking and alcohol consumption**

Smoking during pregnancy is one of the leading modifiable risk factors for stillbirth [50]. Smoking can have short-term effects on the growth and lungs of the baby in utero and on birth outcomes, such as preterm birth [55] and long-term effects on his/her health, including asthma [56], attention deficit hyperactivity disorder [57], cancers [58] and cardiovascular diseases [59, 60]. A study by Lanting et al. (2009) of five national surveys in the Netherlands showed a decrease in smoking during pregnancy in the years 2001-2007, from a prevalence of 13.2% to 7.6% throughout pregnancy [61]. Chapter 4 examines the prevalence of smoking as well as the maternal characteristics associated with smoking during pregnancy.

Similarly alcohol consumption during pregnancy can have short-term effects leading to foetal growth restriction or preterm birth [62]. There are also long-term physical and cognitive effects observed in fetal alcohol syndrome (FAS) and other various forms of alcohol-related disorders called fetal alcohol spectrum disorders (FASD), including the tendency to have addictions, such as alcoholism [63]. It is unclear how much alcohol is needed to cause harm to the developing fetus [62, 63]. The prevalence of any alcohol consumption during pregnancy in the Netherlands has had estimations of 20% and 50% [64, 65]. The prevalence and socio-demographic characteristics associated with alcohol is examined in chapter 3 of this thesis.

**Distal risk factors**

Although socio-demographic factors, such as maternal age, education and ethnicity, are harder or not possible to modify, it is still important to identify and compare groups
with these characteristics in order to determine the extent of health inequality, to
demonstrate the potential for health gain given more beneficial circumstances and to
be able to provide targeted health care to those who need it most. It is also important
to identify other modifiable characteristics associated with these factors, as they may be
mediators in the causal route between socio-demographics and health outcomes. As
socio-demographic factors are not only related to health, but also to health behaviours,
this description of distal factors is also relevant for the next step in the model: ‘Analysis
of the determinants of risk factors’. In this thesis, we examine the relationship between
the distal factors maternal education (as a proxy for socio-economic status) and ethnicity
(as a proxy for immigration) and a wide range of health status and health behavior
indicators during pregnancy (chapters 3 and 4).

Socio-economic status
A systematic review of the effects of socio-economic status (SES) on adverse birth
outcomes reported that 93 of 106 studies had found an association of at least one
measure of low SES (such as income, education, occupation, neighbourhood) with an
adverse outcome [66]. Defining socio-economic status remains difficult, however, as
it can be inter-related with, may result from, or indicated by many other risk factors,
such as education, immigrant status, poor housing, violence, pollution, lack of services
in an area, stress and lifestyle risk factors. A Dutch study, for instance, found that the
relationship between lower maternal education and the birth outcomes preterm birth
and small for gestational age, was mediated by smoking [67]. Education is strongly
related to health [68], and maternal education is a strong determinant of child health
[69, 70]; education is used most often, therefore, as a proxy for socio-economic status.
Various studies have reported inequalities in the rates of preterm birth and stillbirth
according to maternal education across Europe [71, 72].

Living in poor neighbourhoods has also consistently been shown to be associated with
adverse birth outcomes, even after accounting for individual risk factors [73]. There are
still large disparities in perinatal mortality and morbidity between neighbourhoods and
municipalities in the Netherlands [74, 75]. A Dutch study examining perinatal mortality in
Amsterdam in singleton births from 2000 -2006 found vast differences between different
areas in Amsterdam, with the highest perinatal death rate being 1 out every 40 births in
a neighbourhood in Amsterdam South-East compared to 1 out of every 200 births in the
neighbourhoods of Amsterdam South, two areas which are geographically close to each
other [76].

Ethnicity
Disparities according to ethnicity or immigrant status are apparent in all adverse
birth outcomes, as in many other health fields [77, 78]. A perinatal audit conducted
on stillbirths in Amsterdam, showed that the stillbirth rate was significantly higher in Surinamese and other non-Western women (mainly from Ghana) than in native Dutch women [79]. Most of these stillbirths were mainly due to higher rates of early preterm births. Studies from the United States have also reported much disparity between immigrants and non-immigrants in preterm birth and perinatal mortality [80]. In 2004, fetal death rates were twice as high for African-American women living in the United States as for non-Hispanic white women [81]. African-American women in the United States are more likely to experience fetal growth restriction, possibly due to factors as inadequate weight gain. Hispanic women in the United States have higher rates of having infants with congenital defects such as spina bifida, possibly due to the low usage of folic acid [81].

2.3. Analysis of the determinants of risk factors
The third step of the Model for Planned Health Education and Promotion involves endeavoring to understand what the important personal and environmental determinants are of the behavioural risk factors associated with adverse health outcomes, and which determinants are modifiable. Some examples of the personal determinants of behaviours are attitudes, knowledge, self-efficacy and intention. Environmental determinants can be physical (such as the availability of resources in the neighbourhood to promote health), socio-cultural (such as social networks, traditions, ethnicity and educational level), economic (such as the family income) and political (such as national legislation affecting population health)[10]. Various social cognitive and ecological models have been developed to describe how the determinants of health behaviours are related and how they can influence behaviours; other models describe the process of health behaviour change.

We do not address this step of the Model for Planned Health Education and Promotion in this thesis, but this step is important for the development of interventions for health promotion. The I-Change model [82], for example, has been used to understand the experiences and attitudes of both midwives and pregnant women in the Netherlands towards alcohol consumption [83] and to develop a smoking cessation intervention and more recently an alcohol prevention intervention for pregnant women [84, 85]. This model integrates concepts from several models such as the Theory of Planned Behaviour [86] and the Stages of Change model [87]. According to this model, predisposing factors (such as social/cultural, biological and behavioural factors), information factors (such as how the health promotional message is conveyed) and awareness factors (such as knowledge and risk perception) determine motivational factors. Motivational factors (attitudes, social influences and self-efficacy) determine the intention to change behaviour. Abilities and environmental barriers then determine whether this intention leads to actual change. Understanding the determinants which influence motivation to change, intention
to change and actual change, has led to the development of effective interventions addressing those determinants.

2.4. Intervention mapping and implementation: prenatal health education
Once the health issue has been analysed and the risk factors and the determinants of the risk factors have been identified, steps four and five of the Model for Planned Health Education and Promotion involve creating health goals and then developing interventions to achieve those goals. In this thesis, we did not develop and implement a new intervention, but we did assess and evaluate the prenatal health education provided by midwives to clients (chapters 5 and 6).

Pregnancy as a window of opportunity for health behavioural change
Ideally, women should already have a healthy nutrition, not smoke, and practice sufficient physical activity before conception, as many risk factors associated with adverse pregnancy outcomes are already present at conception. A healthy diet during the twelve months before pregnancy, for example, has been found to be associated with a reduced chance of preterm birth [88]. It is difficult to reach all women before conception, however, making early pregnancy perhaps the most effective time to encourage healthy behaviours. Most pregnant women in high income countries, such as the Netherlands, contact a prenatal health care provider for health care during pregnancy. Unlike other health care providers, who tend to see patients with ill health, prenatal health care providers have a unique opportunity to help improve the health of most mothers and their children, by assessing their diets and physical activity, as well as their attitudes towards these health behaviours and possible barriers, and to give health promoting advice accordingly [89]. Although physical pregnancy complaints, such as exhaustion and nausea, could be possible barriers to healthy nutrition and sufficient exercise, pregnant women may be more motivated to improve their health than people at other stages of life, due to wanting the best for their unborn child [90]. It has been suggested that pregnancy is an important period for influencing the life course, as it may be a potential opportunity to instil lifelong changes beyond the pregnancy itself [91].

Prenatal health promotion by midwives
Brief history
Midwives in the Netherlands have always played an important role in supporting women during childbirth, and until the end of the 17th century they had a fairly autonomous role in this function [92]. The 18th century saw a rise in the knowledge of reproductive and foetal anatomy and in medical technology, but this expertise was considered to belong to the field of obstetricians. In 1865 the ‘Law of Medical Practice’ specified separate tasks
and responsibilities for midwives and obstetricians, strengthening the professional role of midwives, but midwives were restricted to assisting childbirth and the postnatal period of uncomplicated pregnancies, and obstetricians were to treat women needing more medical care. It was towards the end of the 19th century that the idea was introduced in Europe that adverse maternal and perinatal outcomes could be reduced not only by caring for women during child birth, but during pregnancy as well, although this care was initially carried out by obstetricians [93]. Around 1917, a Dutch obstetrician De Snoo, for example, started advising a salt-reduced diet for pregnant women to prevent pre-eclampsia, and also recommended weighing them and taking their blood pressure regularly during pregnancy. It was eventually recognized that midwives could play a greater public health and social role beyond the childbirth itself, such as educating the families whom they visited [94]. From 1932, a new law permitted midwives to care for women from the second half of pregnancy and from 1951 they could care for women throughout their entire pregnancy, provided there were no complications. Since 1987, the revised Obstetrical Indications List (consisting of maternal indications which require and do not require referral to an obstetrician) led to midwives officially having the role of assessing the medical risk of a pregnant woman, and determining whether or not she be should be referred to care under an obstetrician.

Although midwives have always been considered as having an important public health role in reducing maternal and child morbidity and mortality, literature is scarce on what health educational information they actually provided to pregnant women during prenatal care. Before the introduction of prenatal counselling for Down Syndrome testing in 2007, the first prenatal visit with the midwife was around 12 weeks of pregnancy [9], which would have been relatively late to start discussing many of the important health behaviours for pregnancy. The most recent official Dutch guideline written for midwives in 2008 recommends that the first prenatal visit should be between 6 and 8 weeks, and advises midwives to provide education on nutrition and physical activity, although it does not specify what information to give [9].

Current prenatal health promotion
The majority of midwives consider pregnancy to be a physiologically normal event, as opposed to a medical event needing intervention, suggesting that the midwifery profession is primarily about promoting and ensuring good maternal and child health [95]. Interventions to prevent the morbidity and mortality associated with low birth weight and preterm births have mainly been carried out in tertiary care, which include administering medications such as antibiotics and tocolytic drugs [96]. However researchers examining these interventions have concluded that they are not effective for preventing preterm birth at population level [96, 97]. Some interventions only work for a select group of women at risk, or only help to delay very preterm births, and some
are associated with dangerous side-effects for the mother and child. Although medical interventions are becoming more successful in increasing the survival rates of preterm born children, they may not be able to prevent the lifelong morbidity often associated with low birth weight or preterm birth. Interventions in primary care are likely to be the most effective in reducing the chances of adverse birth outcomes and later ill-health [25, 97]. A Cochrane review reported that continuity of care by primary care midwives, for instance, was associated with a decrease in preterm births [98].

There are interventions currently being carried out by midwife practices for pregnant women who smoke, and more recently to prevent alcohol consumption [84, 85]. The VMIS (Minimal Intervention Strategy to Stop Smoking for the Midwife Practice) is an intervention based on the I-Change model [99] that has been developed for midwives to assist in smoking cessation counselling. Components of the intervention include assessing a pregnant woman’s smoking status, her motivation and possible barriers to stop smoking, providing advice and resources, and arranging a smoking cessation date. Its usage has greatly increased since 2011 after being made mandatory by the Dutch Healthcare Inspectorate, but it is still not implemented everywhere and completely [100, 101]. There have been varying conclusions about its effects, although this may have to do with the extent that the intervention is being carried out completely [99, 100].

There are currently no guidelines for midwives in the Netherlands on what information to provide to clients with regard to healthy nutrition and physical activity. Previous international and national studies report that relatively little information is given by prenatal health care providers on nutrition and that pregnant women would like to have more information [102, 103]. One Dutch study revealed that nutritional advice is only provided in broad terms [102] and another that little advice is given during the prenatal visit about alcohol consumption [104]. There is some evidence that providing dietary counselling during pregnancy can influence the nutritional behaviours of pregnant women [105, 106] and education promoting physical activity can improve knowledge about and levels of physical activity during pregnancy [107, 108].

Very few studies have examined health behaviour education, as provided by midwives during prenatal care in the Netherlands. More research is needed to examine the extent, content and manner of health education to pregnant women on all relevant health behaviour topics, as well as pregnant women’s experiences and needs regarding prenatal health education. In this thesis we explore the experiences of health education provided by the midwife as reported by pregnant women (chapter 5) and we examine the actual extent of health behaviour information provided by primary care midwives during video-recorded prenatal booking visits (chapter 6).
3. Outline of this thesis

This thesis is divided into two main parts: (1) **Prevalence and characteristics of maternal/perinatal health and maternal health behaviours** and (2) **Prenatal health education provided by primary care midwives**. We used the Model for Planned Health Promotion as a framework to structure our research. In part 1, we contribute to the first three steps *Analysis of health and quality of life, Analysis of risk factors, and Analysis of the determinants of risk factors* by the research presented in chapters two, three and four. In chapter two we examine the prevalence of spontaneous preterm birth in nulliparous women, and the relationships of maternal health behaviours and psychological characteristics with having a spontaneous preterm birth. Chapter three presents an overview of the health status and health behaviours of pregnant women in primary care living in the Netherlands, and the extent of sociodemographic health and health behaviour inequalities which are currently present. Chapter four focuses on one well known suboptimal maternal health behaviour in the Netherlands, i.e. smoking during pregnancy, and identifies the socio-demographic and lifestyle-related characteristics which are associated with any, daily and occasional smoking during pregnancy.

In part 2 of the thesis, the evaluation of step five *Intervention implementation* is the focus of chapters five and six. Chapter five explores pregnant women’s experiences with the health education they received from their midwives during pregnancy. Chapter six is a video analysis of actual prenatal booking visits of midwives and their clients, in which we examine the extent of information currently given by midwives in primary care to their clients regarding many relevant health behaviour topics. Chapter seven summarizes the findings in this thesis and discusses some methodological issues, implications for practice and recommendations for further research. Chapter eight provides a summary of each study conducted in this thesis in English and Dutch.
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