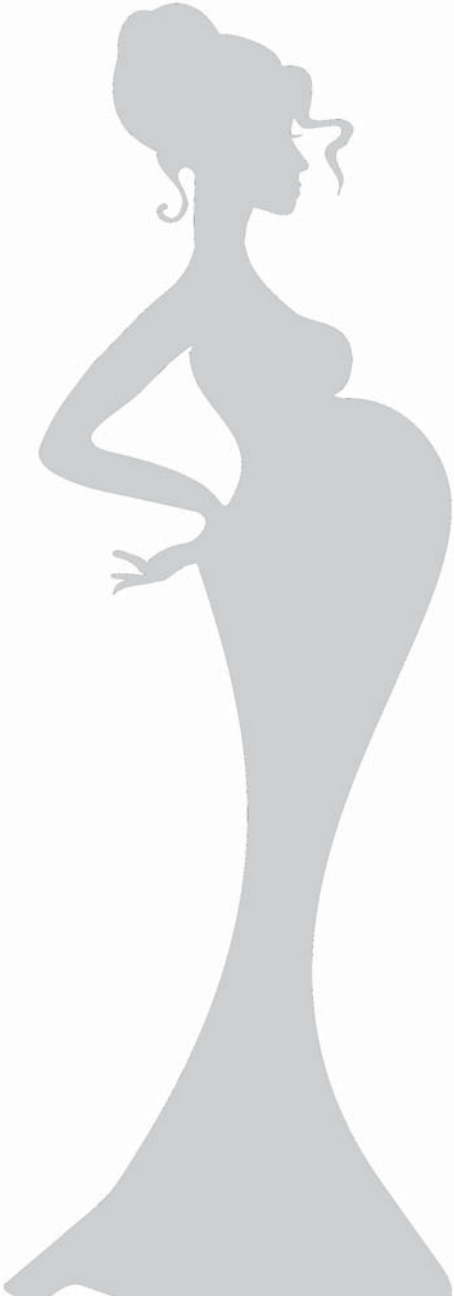


# Chapter 7

**General discussion and  
future perspectives**



During pregnancy, toxoplasmosis, listeriosis, CMV infection and chlamydia can lead to maternal disease, adverse pregnancy outcomes or subsequent neonatal disease. In pregnancy, women are not routinely tested for toxoplasmosis, listeriosis or CMV infection in the Netherlands, but they are only tested if there is a suspicion that the woman was exposed to one of these pathogens. Regarding chlamydia infection, the policy in the Netherlands is to test only women who are at high risk for the infection. In order to lower infection rates and subsequent neonatal disease in the foetus or new-born, midwives should inform pregnant women about methods to prevent toxoplasmosis, listeriosis and CMV infection, and regarding chlamydia perform adequate risk assessment.

Therefore, the overall aim of this thesis was to gain insight into the role of clients and midwives in preventing infectious diseases during pregnancy. The first aim of this thesis was to assess the knowledge of, and risk behaviour related to toxoplasmosis, listeriosis and CMV infection among pregnant women. The second aim was to assess the knowledge of pregnant women and their partners about *Chlamydia trachomatis* infection, and their attitudes and experiences towards testing. The third aim was to assess the knowledge and the actual amount of health education provision of toxoplasmosis, listeriosis and CMV, and the test practices and attitudes towards testing for *Chlamydia trachomatis* among primary care midwives in the Netherlands.

## **Part I: Toxoplasmosis, listeriosis and cytomegalovirus**

Toxoplasmosis, listeriosis and CMV infection can all negatively affect pregnancy outcomes, but can be prevented by lifestyle and behaviour habits of pregnant woman (1-5). Information provision by midwives about methods to prevent these infections can support women to change their lifestyle and behavioural habits in order to prevent adverse pregnancy outcomes and neonatal disease (6, 7).

### **Health education: Pregnant women**

In a cross-sectional study, we found that many pregnant women had never heard of toxoplasmosis, listeriosis and CMV, nor did they know how to prevent these infections during pregnancy (chapter 2). However, disease specific knowledge about toxoplasmosis, listeriosis and CMV among pregnant women was not necessarily required to show preventive behaviour during pregnancy. Conversely, a lack of knowledge was not always associated with engaging in risk behaviour. These findings can be confirmed by other studies on this topic, or by studies on alcohol (5, 8-11).

Many women know they should not drink alcohol during pregnancy, without exactly knowing the effects of alcohol on the foetus (8). According to the Health Belief Model, major life-events are 'cues to action' in the process of changing behaviour (12). Pregnancy is a major life-event, and pregnant women are more likely and willing to change behaviour compared to the general population (4, 13). One might have had expected that certain pregnant women's characteristics, such as low socio-economic status, ethnic minorities and low educational level, would be associated with increased risk behaviour for not preventing infectious diseases, as these determinants are also associated with other risk behaviour in pregnancy (e.g. maternal smoking, no folic acid use) (14). And although we did find that women who did not take folic acid during their first trimester of pregnancy were more likely to engage in risk behaviour, we also found that pregnant women with higher educational levels or the Dutch nationality more often reported risk behaviour regarding infectious diseases. Again, these findings are comparable with alcohol consumption during pregnancy: higher educated women are more likely to reduce alcohol consumption during pregnancy instead of to quit alcohol consumption than women with lower educational levels (15).

Concerning CMV infection, there was a general lack of awareness and knowledge among pregnant women and the majority of pregnant women did not adopt hygienic methods to prevent CMV infections. This may be explained by the fact that prenatal health care professionals do not have a comprehensive knowledge about the disease and therefore are not able to properly inform their clients about CMV infection prevention methods, which can be confirmed by our study described in chapter 4 and by other studies (16-19).

When we compare our results to the Health Belief Model, the decision of people to exhibit healthy behaviour is determined by the perceived risk perception and the evaluation of the recommended behaviour (10, 12). Therefore, it is possible that the women who reported risk behaviour in our study may have been more aware of the low risk for acquiring an infection during pregnancy. We also showed that pregnant women's knowledge and risk behaviour were not always associated. Pregnant women receive a lot of information during the first prenatal visit and cognitive shortcuts may arise (20). This may be an explanation for the fact that pregnant women were avoiding risk behaviour without knowing what they were avoiding. Therefore, we would recommend to put more emphasis on preventive methods than on knowledge in prenatal health care.

In addition, according to the Health Belief Model, information provision and advice from other people are, besides life-events, also mentioned as 'cues to action' in the process of behavioural change (12, 21). With regard to advice from health care providers and family and friends, this thesis confirms that these sources of information play an important role in adopting behaviour or lifestyle habits for infectious disease prevention, as many of the pregnant women, in this and other studies received information from their health care provider or from family and friends (3, 10, 11, 22-24). Besides verbally provided information by health care professionals, many primary care midwives provide informative brochures to their clients, for example the brochure "Pregnant!" and "Prevent infections, especially now" (25, 26). In the Netherlands, "Pregnant!" is most often provided and captures information on being pregnant and on the Dutch prenatal health care system. However, this brochure does not mention all methods to prevent toxoplasmosis, listeriosis and CMV infections. The brochure "Prevent infections, especially now" does, but this brochure is not commonly provided. Finally, an important non-verbal source of information was the Internet, but the brochures hardly mention any Internet website where pregnant women can find reliable information on infectious disease prevention.

### **Health education: midwives**

In an observational study using videotaped intake consultations, we showed that in most videotaped consultations midwives provided some information about methods to prevent toxoplasmosis and listeriosis, but not for CMV infection. There was a wide variation in the provision of information between midwives and also between consultations by the same midwife. Midwives provided more information to primigravidae women and also when the consultation lasted longer than the recommended 50 minutes (chapter 3) (27). Prevention methods the least mentioned were washing and peeling raw fruits and vegetables, gardening with gloves, properly reheating ready-to-eat foods, not sharing utensils and cups with young children and hand washing after diaper change. In addition, these prevention methods were also not well adopted by pregnant women (chapter 2). This is of importance, as a study in the United States showed that up to 4.7% of all ready-to-eat foods may be contaminated with listeriosis (28), and one of the main risk factors for toxoplasmosis is soil contact (29). In addition, studies suggest that educational interventions on hygienic practices, such as hand washing after diaper change, have the potential to be a feasible primary prevention strategy (1).

It could be possible that the variation we found between midwives and between consultations is accounted for by the individualisation and tailoring of information provided to each client. In addition, tailoring information provision may also explain why midwives provide more information to primigravidae women than to multigravidae women. However, because the videotaped consultations captured the first visit of pregnant women with their midwife, it is unlikely that midwives had much prior knowledge about clients on which to base individualising the information. Another explanation for the wide variation in provided methods to prevent toxoplasmosis, listeriosis and CMV infection, may be time constraints (3, 22). However, even in the longest videotaped consultation, not all prevention methods were mentioned.

Specifically regarding CMV, we showed in our cross-sectional study among primary care midwives in the Netherlands, that the majority of midwives did not have comprehensive knowledge levels about transmission routes and maternal symptoms of CMV (chapter 4). Although they had knowledge about saliva as a transmission route, they did not generalize it to other bodily fluids as urine and breast milk. This may indicate that Dutch primary care midwives lack the underlying understanding of infectious disease transmission routes. Confirmed by other studies, the majority of midwives acknowledged that they did not have a comprehensive knowledge about CMV transmission, and therefore, the majority did not inform their clients about hygienic measures to prevent maternal CMV infection (16, 30, 31). Other reasons we found for not informing pregnant women were the perception that maternal CMV infection is rare; that midwives never think about providing information about CMV infection prevention; or that they never learned to do it during midwifery education. Another explanation for the low levels of provided information on CMV infection prevention is that midwives might doubt the practicability of CMV prevention, for example not sharing utensils used by young children seems very difficult. However, previous studies report that women are willing to adopt these types of prevention methods during pregnancy (3, 4, 32, 33).

One may argue that there is not enough evidence from randomized controlled trials about the effects of prenatal health education on reducing the risk for infections (34, 35). However, pregnant women are more likely to change their behaviour than the general population and they are more likely to change their behaviour when they receive advice from a health care professional (4, 22). In addition, observational studies suggest that verbally provided prenatal health education may be highly effective (1, 2, 4, 32). For example, one of the studies suggests that hygienic interventions may reduce the frequency of child to mother transmission and thus acquiring maternal

CMV infection by 84% (4), and another study showed a two-fold reduction of the risk for acquiring CMV infection in pregnant women (32). Therefore, we think that it is important to follow current best practices to prevent infectious diseases by prenatal health education, until the effectiveness of such educational interventions is determined. In addition, pregnant women deserve to be informed about methods to prevent infectious diseases in pregnancy.

### **Overall conclusion Part I**

Many of the Dutch pregnant women we studied had never heard of toxoplasmosis, listeriosis or CMV infection, nor did they know how to prevent these infections during pregnancy. However, many pregnant women were actually avoiding risk behaviour, without knowing what they were avoiding. However, the least mentioned preventive methods by the primary care midwives studied were also the methods that were least adopted by pregnant women. Therefore, this thesis indicates that the amount of provided information by midwives on methods to prevent toxoplasmosis, listeriosis and CMV infection is insufficient.

The lack of information provided on CMV infection prevention is striking. Congenital CMV infection is an important public health problem in pregnant women and their newborn infants. Many midwives did not have a comprehensive understanding of this viral infection and because of their lack of knowledge they often do not provide information to prevent this infection to pregnant women.

To increase awareness among midwives, better education on toxoplasmosis, listeriosis and especially on CMV infection is important. Awareness of midwives is essential for the awareness of pregnant women. Although it may be less important to inform pregnant women about specific infectious diseases, it remains important that midwives continue advising pregnant women about behaviours and lifestyle habits that can prevent infectious diseases during their first prenatal care visit, regardless of their age, parity or other demographic characteristics. It is important that educational materials regarding infectious disease prevention for pregnant women and midwives are complete and accurate. With these measures many cases of maternal toxoplasmosis, listeriosis and CMV and neonatal morbidity could be prevented.

### **Recommendations: Midwifery practice**

Pregnant women receive a lot of information during their first prenatal visit, and thus may not remember specific infectious disease related information. However, it seems

that they do remember which behaviour they should adopt and avoid to prevent infectious diseases, without knowing what they are avoiding. Therefore, it may only be necessary for midwives to inform pregnant women briefly about the methods to prevent infectious diseases and to repeat some information during a later stage in pregnancy. In addition, we recommend to midwives that they take enough time for the first consultation in order to give complete and accurate information about methods to prevent toxoplasmosis, listeriosis and CMV infection to their clients, as pregnant women deserve to be informed about methods to prevent these infections. In general, more emphasis is needed for some preventive methods, including washing and peeling raw fruits and vegetables, gardening with gloves, properly reheating ready-to-eat foods, not sharing utensils and cups with young children and hand washing after diaper change. These prevention methods were the least provided prevention methods by midwives to their clients and were also not well adopted by pregnant women.

For health policy makers, we recommend to facilitate health education for pregnant women in preventing infectious diseases by providing reliable information in brochures and on websites. Existing brochures for pregnant women should be updated with relevant information on infectious disease prevention methods. Brochures should include information on reliable websites, as, besides information from midwives, the Internet is an important source of information for pregnant women. Finally, we strongly recommend that educational materials for pregnant women and midwives are updated about methods to prevent CMV infection. Standardised educational materials for midwives as part of their education, and for women as part of their prenatal care may support the provision of consistent and accurate information for women.

### **Future research**

In our study about risk behaviour of pregnant women we did not test pregnant women for toxoplasmosis, listeriosis and CMV infections. Therefore, it would be interesting to study the association between risk behaviour of pregnant women and actually acquired infections, to gain insight into risk behaviours that are most associated with infections. Since the number of cases of toxoplasmosis and listeriosis may be small, cooperation between different countries to create a large cohort should be necessary. In addition, we highly recommend to set up a randomized controlled trial in order to determine the effectiveness of different types of health education (verbal versus written, the Internet or other sources of information) on preventing infectious

diseases in pregnancy, as currently no strong evidence exists. In addition, research into the feasibility of hygiene interventions to prevent CMV infections is necessary.

## **Part II: *Chlamydia trachomatis* infection**

In pregnant women, chlamydia infection may cause adverse pregnancy outcomes, or subsequent maternal and neonatal disease (36). In the Netherlands, chlamydia screening during pregnancy is recommended when the patient's history suggests relevant risk exposure. Therefore, primary care midwives should practice adequate risk factor based screening in order to detect cases of chlamydia infection and prevent sequel from the disease.

### **Chlamydia testing: Pregnant women & Partners**

According to the screening criteria for appraising the validity of a screening program as described by Wilson and Jungner, screening for asymptomatic chlamydia infection in pregnant women fulfils these criteria; the infection is an important public health problem in pregnant women, the natural history of chlamydia is well understood, the infection is easily detectable in an early stage in pregnancy, treatment is effective and it seems that the costs are balanced against the benefits (65, 68-70). Wilson and Jungner also described that the physical and psychological risks should be less than the benefits. Until now, not many studies assessed the psychological consequences of being tested for chlamydia in pregnant women (70).

Our findings in chapter 5 among 383 pregnant women and 282 partners indicate that screening in antenatal care is highly acceptable and the majority of pregnant women and their partners experienced no negative feelings when the test was offered to them during a consultation at the midwifery practice. These findings are confirmed by another study from Australia, which found that pregnant women indicated a high level of acceptance for chlamydia screening in antenatal care as they were willing to undertake whatever care was necessary to ensure the health of their unborn baby (13). Women who had a positive test result had mixed reactions; although most of them felt relief and gratitude for having had chlamydia detected (13). In addition, in the Netherlands all pregnant women are already screened for other STIs, as HIV, hepatitis B and syphilis and uptake for these screening tests is high (71). Adding chlamydia testing to this battery should be feasible. Finally, we think that targeted screening as recommended by the Dutch Health Council, has the potential to stigmatize women (49).



Besides the screening criteria described by Wilson and Jungner, a key factor for an effective screening program is that women have some knowledge about the infection and there must be a certain level of public awareness (57). In the same study as described above, we found that the majority of pregnant women and partners was aware that chlamydia is an STI and that they had some knowledge about the infection, which is comparable to other studies (57, 72, 73). In addition, our study found lower knowledge scores in certain subgroups of participants: partners of pregnant women, participants aged 21 years and younger compared to older participants, ethnic groups of non-western origin compared to Dutch or western origin, and participants with a low educational level compared to participants with an intermediate or high educational level. These findings are indirectly comparable with the uptake of screening programs for chlamydia, as these subgroups often have lower participation rates (74). This indicates that knowledge about the disease and screening uptake may be related. This is of importance, as the subgroups we found with lower knowledge scores are also at a higher risk for having a chlamydia infection (13, 48, 55). Moreover, participants with a previous history of STI had more knowledge about chlamydia than participants who had never had an STI or had never been tested for an STI, which may contribute to the fact that persons who had been tested positive are more likely to retain information or because they had a greater understanding of chlamydia (13, 57).

Finally, partners of pregnant women may transmit chlamydia during pregnancy and in asymptomatic couples only half of partners seem infected by testing at one time-point (75). As described in chapter 5, we tested 627 participants for chlamydia infection. And although we did not find high prevalence rates among pregnant women and partners (overall 2.2%), we detected two chlamydia positive partners while their pregnant partners were found negative. In the Netherlands, as in many other countries, partners are not clients of midwives; therefore, the most feasible approach is to retest pregnant women who are at increased risk for chlamydia during the third trimester. These approaches are already recommended in some international guidelines (51, 52, 54), and are effective in identifying a positive third trimester *Chlamydia trachomatis* infection after a negative first trimester test (76).

### **Chlamydia testing: Midwives**

Knowledge about symptoms of chlamydia and possible adverse pregnancy outcomes is essential for effective management using a risk assessment approach in order to identify chlamydia infections in pregnant women (37, 38). In our cross-sectional study (chapter 6) about knowledge and chlamydia test practices among primary midwives in

the Netherlands, we showed that midwives had knowledge about chlamydia infection in terms of symptoms of the disease, but they had less knowledge about adverse pregnancy outcomes and subsequent neonatal disease. A possible explanation for the lower knowledge scores may be the contradicting evidence regarding pregnancy outcomes related to chlamydia infection. According to previous research pregnancy outcomes associated with chlamydia are spontaneous abortion (39, 40), preterm rupture of membranes (41-43), preterm labour (42-44), low birth weight (42, 44, 45), and perinatal mortality (44, 46). A meta-analysis of cohort and case-control studies among pregnant women who underwent medical follow-up before and after childbirth, evaluated the effect of chlamydia infection in pregnancy on perinatal outcomes and found an increased risk for preterm labour, low birth weight and perinatal mortality (47). A more recent non-intervention study from the Netherlands assessed the effect of chlamydia infection during pregnancy on premature labour and birth weight, and confirmed only preterm labour as a consequence of the infection (48).

In chapter 6 we described, based on the recommendation of the Dutch Health Council, that midwives showed inadequate risk assessment behaviour in order to identify pregnant women who are at increased risk for chlamydial infection (49). The Dutch Health Council recommends that health care professionals should actively screen for chlamydia infections in persons who are at higher risk for the infection, and risk factor based screening should be used. Although, in industrialized countries, recommendations towards universal chlamydia screening of pregnant women, or screening all pregnant women aged less than 24 years, and those at a higher risk of a reinfection in the third trimester, already exist (50-54), a specific recommendation for chlamydia screening in pregnant women in the Netherlands is lacking (49). Main reasons for midwives to test pregnant women for chlamydia were based on the woman's own request or on symptoms of the disease, which is comparable with the knowledge levels regarding this topic as described above. Both of these approaches for screening are likely to under-diagnose cases of chlamydia, as pregnant women infected with *Chlamydia trachomatis* do not perceive themselves or their sexual partners as being infected or at risk for the infection (55, 56). Therefore, testing should not be based on the self-perceived risk of pregnant women. In addition, chlamydia is in most women asymptomatic, and if symptoms are present, they are often non-specific (36). Symptoms as vaginal discharge, frequent or burning micturition, and lower abdominal pain are too mild to be mentioned spontaneously by pregnant women, and may be often mistaken for general pregnancy related symptoms or

discomforts. Unfortunately, midwives' risk approach for screening pregnant women for chlamydia was rarely based on demographic risk factors.

Studies in industrialized countries identified younger age, low educational level, certain ethnic subgroups as Antillean and Surinamese women, primigravidae women, single marital status, multiple sexual partners in the year prior to pregnancy, and prior history of sexually transmitted infections as demographical and behavioural risk factors for chlamydia infection in pregnant women (48, 55, 57-59). Not many studies evaluated the behavioural risk factors, and although in a Dutch study multiple sexual partners did not remain a significant risk factor in adjusted analyses, a study from Australia showed that this was the strongest predictor for having a chlamydia infection (48, 55). If an assessment of a women's sexual risk is used for selective screening, midwives and other antenatal health care professionals need to be comfortable asking about recent sexual history. Studies indicate that target screening may be hampered by health care professionals' discomfort in speaking openly with clients about sexual behaviour (60, 61). This is confirmed by our study, as almost half of the participating midwives indicated that multiple sexual partners in the year prior pregnancy was a reason to test pregnant women for chlamydia infection, the majority of midwives indicated to never ask this question to their pregnant clients, and they indicated this questions as somewhat difficult or difficult to ask. Finally, in the general population in the Netherlands, opportunistic screening for chlamydia infection may not be feasible due to low participation rates and therefore targeted screening seems feasible and effective (62, 63). Studies among pregnant women showed different evidence about the effectiveness of targeted screening. One study showed that only a minority of infected women would be detected by using only demographical risk factors (i.e. age less than 25 years) for the infection as recommended by international guidelines (64). Another study showed that more chlamydia positive pregnant women could be detected if risk behaviours as multiple sexual partners in the year prior to pregnancy was included in the prediction model (55). However, even with the latter approach, a proportion of pregnant women with a chlamydia infection is still missed (55). In addition, a study from the Netherlands showed that universal screening in pregnant women is cost-effective (65). Finally, another requisite for a successful chlamydia screening program is that health care providers have positive attitudes towards screening, as their attitudes may influence their management of chlamydia screening and testing (66, 67). The midwives studied in chapter 6 had positive attitudes towards universal or selective screening for chlamydia infection in antenatal care, as the majority indicated that all pregnant women, or women at increased risk should be

tested for the infection. The results described above suggest that universal screening should be promoted unless selective screening criteria can be validated.

### **Overall conclusion Part II**

Midwives showed knowledge about the symptoms chlamydia infection can cause, but showed limited knowledge regarding the consequences of chlamydia infection in pregnant women. In addition, based on the recommendations of the Dutch Health Council, midwives practice inappropriate risk factor based screening; midwives primarily tested pregnant women for the infection based on symptoms of the infection, instead of the demographical risk factors or risk behaviour. Furthermore, midwives do not feel comfortable in asking specific questions about sexual behaviour, in order to identify those who are at highest risk for having a chlamydia infection. This may result in under-diagnosis and under-treatment of chlamydia infection in pregnant women.

Midwives and pregnant women, as well the partners of pregnant women, showed positive attitudes towards universal testing for chlamydia. And as most pregnant women in the Netherlands seek antenatal care early in pregnancy, we believe that increasing midwives' knowledge levels and following the practices of other countries, a national guideline promoting universal antenatal screening for chlamydia in the first trimester of pregnancy, and again in the third trimester for those at high risk for the infection, may help reduce complications associated with the infection, and may minimize feelings of stigmatization in pregnant women. Hence, universal screening for chlamydia is a good opportunity to reduce maternal and neonatal morbidity, resulting from *Chlamydia trachomatis* infection.

### **Recommendations: Midwifery practice**

It is important that midwives increase their knowledge about the risk factors for having a chlamydia infection, and about the severity of the infection in pregnant women. Midwives working in primary care settings should receive additional training and educational materials about these topics, and education about the infection should be implemented in midwifery undergraduate and postgraduate education programs. Hence, increased knowledge among midwives may contribute to a higher awareness of the infection and more frequent testing for chlamydia infections in pregnant women.

Health policy makers should consider including chlamydia screening in the standard antenatal test battery for infectious diseases.

### **Future research**

Future research among pregnant women should focus on testing based on demographical and especially on behavioural risk factors, including age, sexual behaviour and local prevalence to develop improved chlamydia case detection methods. In addition, more research into the prevalence rates of chlamydia infection in pregnant women in multiple locations in the Netherlands is necessary, in order to determine the public health impact of the infection, and in order to develop a valid prediction model to detect those women at the highest risk for infection. New studies about pregnancy outcomes could possibly provide more consistency in the link between chlamydia infections in pregnant women and adverse pregnancy outcomes.

Finally, future research about the pregnant women's barriers for getting tested for a chlamydia infection is necessary and the views of midwives regarding testing partners of pregnant women should be explored.

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