This is the pre-peer reviewed version of the following article:
Merkx A, Ausems M, Budé L, de Vries R, Nieuwenhuijze, MJ. Factors affecting perceived change in physical activity in pregnancy. Midwifery. 2017;51:16-23,
which has been published in final form at https://doi.org/10.1016/j.midw.2017.05.007

How and why do healthy pregnant women change their physical activity in pregnancy?

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Abstract

Objective
Reduction of physical activity (PA) during pregnancy is common but undesirable, as it is associated with negative outcomes, including high gestational weight gain. Our objective was to explore change in five types of activity and the behavioural determinants related to change in PA.

Design
Secondary analyses of an exploratory cross sectional survey among healthy pregnant women (n=455) of all gestational ages. We used a hypothetical model, based on the ASE-Model (attitude, social influence, self-efficacy) to construct the questionnaire and analysed our data using descriptive and inferential statistics.

Participants
455 healthy pregnant women of all gestational ages, receiving prenatal care form midwifery practices.

Findings
More than half of the women reported reduction in their PA during pregnancy. Highest reduction was reported in sports and brief rigorous activities, but other types of PA were reduced as well. Reduction of PA was seen more in women who considered themselves as active before pregnancy, women who experienced pregnancy-related barriers, women who were advised to reduce their PA and multiparous women. Fewer than 5% increased their PA. Motivation to engage in PA was positively associated with enjoying PA.

Key conclusions and implications for practice
More than half of the pregnant women reduced their PA during pregnancy. Our findings concerning the predictors of PA reduction can be used to develop an evidence-based intervention aimed at encouraging healthy PA during pregnancy. All pregnant women should be informed about the positive effects of staying active and should be encouraged to engage in or to continue moderate intensive activities like walking, biking or swimming.

Keywords
Survey, physical activity, health promotion, promoting healthy pregnancy, ASE-model, pregnancy

Introduction
Physical activity (PA) in pregnancy improves pregnancy outcomes (Adamo, et al., 2012, Buschur and Kim, 2012, Downs, et al., 2012, Ferraro, et al., 2012, Melzer, et al., 2010, Mudd, et al., 2013). Being physically active is associated with lower incidence of pre-eclampsia, gestational diabetes, varicose veins, lower back pain, Caesarean section, post-partum anxiety and depression, adverse birth weight and is associated with improved appetite control, fitness, pain coping during birth and healthy gestational weight gain (Adamo, et al., 2012, Buschur and Kim, 2012, Downs, et al., 2012, Ferraro, et al., 2012, Melzer, et al., 2010, Mudd, et al., 2013). Conflicting evidence is found in relation to a decrease of nausea, heartburn, round ligament pain, leg cramps, duration of labour, improved sleep experience and quality of life in active women, with some researchers finding a positive and others finding no association (Buschur and Kim, 2012).

Canada, the United States of America and the United Kingdom have published national guidelines for PA by pregnant women, based on World Health Organisation (WHO) recommendations (ACOG, 2015, Buschur and Kim, 2012, Evenson, et al., 2014). In the Netherlands the WHO guidelines have been used to develop guidelines for PA for the general population, but there are no guidelines for PA by pregnant women (Evenson, et al., 2014). In this paper, we use the Dutch activity norm -at least five times a week, 30 minutes per day of moderately intense activity, described as “activity where the person needs to breath more and heart rate increases (for instance brisk walking or biking), but the activity is not exhausting”- as the definition of healthy PA for healthy pregnant women (NISB, 2015).

Globally, around 34% of women over 15 were insufficiently active in 2008 (WHO, 2014) When pregnant, many women show a reduction in PA (Adegboye, et al., 2010, Cohen, et al., 2013, Gaston and Cramp, 2011, Poudevigne and O'Connor, 2006). Depending on time, sample and method of measurement, this reduction in PA occurs in as few as 7% and as many as 69% of pregnant women. Only a few women increase their PA (Poudevigne and O'Connor, 2006).

A review of 25 studies of the patterns and determinants of PA in pregnancy, found that a low level of PA is associated with low income, low education, more children in the home, ethnicity other than white and lower pre-pregnancy activity (Gaston and Cramp, 2011), physical complaints (Weir, et al., 2010), lack of resources in social environment (Laraia, et al., 2007), and lack of social support (Clarke and Gross, 2004). The literature is inconsistent about the influence of parity, employment, pre-pregnancy BMI, age and smoking (Gaston and Cramp, 2011). Higher self-efficacy expectations and positive beliefs are associated with increased PA in pregnancy (Gaston and Cramp, 2011). Level of PA is furthermore associated with the information provided (Cannella, et al., 2010, Weir, et al., 2010), and beliefs about the risks and benefits of PA in pregnancy (Da Costa and Ireland, 2013, Evenson and Bradley, 2010, Johnson, et al., 2013). Although it is likely that women reduce their PA because of an increased tiredness, a growing belly, and the combination of pregnancy and unwanted types of PA (such as contact sports), reducing PA is undesirable especially for women with low levels of PA before pregnancy (WHO, 2014). If these women further reduce their PA, they are at increased risk for negative outcomes of pregnancy and birth (Adamo, et al., 2012, Buschur and Kim, 2012, Downs, et al., 2012, Ferraro, et al., 2012, Melzer, et al., 2010, Mudd, et al., 2013).

Most studies based their research on objective measurements of PA, while some explored a subjective perception of change in PA in pregnancy (Althuizen, et al., 2009). While the first method provides a more consistent measure, the latter can be better applicable in prenatal practice. During the day, women have shorter and longer moments of PA, it takes a lot of administration -and therefore time- to find out the exact types and duration of PA a woman has. It can be easier to ask women whether they perceive a change in their PA in pregnancy, why they changed and how they changed. In a previous study, we discovered that women who perceived a decrease in their PA during pregnancy were more likely to have a higher gestational weight gain (Merkx, et al., 2015). This current paper describes the secondary analysis of the data of our previous study, aiming to understand changes in various type of PA in pregnancy and to uncover the factors associated with an overall perceived change in PA in healthy pregnant women. Our goal is to identify what is necessary to build interventions that will prevent the reduction of PA and perhaps stimulate an increase in PA.

Methods

We performed a secondary analyses of data collected in an exploratory cross-sectional survey of a sample of healthy pregnant women (defined as pregnant women not needing specialist obstetric care) of all gestational ages (Merkx, et al., 2015).

Procedure

The study was part of the bigger research project "Promoting Healthy Pregnancy" designed to develop an evidence-based intervention to increase the number of women achieving healthy gestational weight gain. We worked together with the "Promoting Healthy Pregnancy" Consortium, a group of midwives, other health professionals and researchers. Between September and November 2012, healthy pregnant women of all gestational ages were recruited via 30 midwife-led community practices in the Netherlands. Women who expressed an interest in participating in the study were telephoned by the researcher, who explained the study aim and procedures. Women agreeing to participate were asked to return a written completed consent form. A study questionnaire was then -on request- sent by email. More detailed description of recruitment of participants is described earlier (Merkx, et al., 2015). The Research Ethics Committee of Atrium-Orbis-Zuyd reviewed the study protocol and confirmed that ethical approval was not required, because of the non-invasive character of the study.

Hypothetical model

We used the Attitude-Social influence-self-Efficacy (ASE)-model (Norman and Abraham, 2000), to explain the change in PA of the participants. The ASE-model is an extension of the frequently used Theory of Planned Behaviour (Ajzen, 1991, Ajzen, 2011, Norman and Abraham, 2000). According to the ASE-model, the particular behaviour is explained by a person's intention to perform the behaviour, which is in turn determined by attitudes (beliefs about the particular behaviour), social influences (perceptions of social norms, social support or pressure and role models) and self-efficacy (a person's expectations regarding her capability to perform that behaviour) (Ajzen, 1991, Ajzen, 2011, Norman and Abraham, 2000). Barriers to perform the behaviour can inhibit the behaviour (Ajzen, 1991, Ajzen, 2011, Norman and Abraham, 2000). We defined women's "intention to perform" as "motivation to engage in healthy PA" (Weinstein, et al., 2008). We hypothesized that women with higher scores on "motivation to engage in healthy PA" would reduce their PA to a lesser extent. Based on existing research (Cannella, et al., 2010, Clarke and Gross, 2004, Evenson and Bradley, 2010, Gaston and Cramp, 2011, Johnson, et al., 2013, Laraia, et al., 2007, Weir, et al., 2010) we hypothesized that (self-reported) pre-pregnancy PA and the degree of eagerness to seek information about pregnancy would influence the change in PA as well. Our hypothetical model is shown in Figure 1.

Please insert Figure 1 and Caption Figure 1

Questionnaire

We developed our questionnaire in consultation with midwives, other health professionals, and student midwives to enhance the face validity of our questionnaire (Merkx, et al., 2015).

Demographics/characteristics

We calculated *age* using date of birth and date of completing the questionnaire. Using a government definition, *ethnicity* was Dutch if both parents were born in the Netherlands and otherwise non-Dutch (CBS, 2014). *Family income* was "low" when it was below national modal income (33,000 euro/year) and high if it was above the mode (CPB, 2015). *Education* was "low" for women without a high school diploma, "medium" for women with high school diploma and "high" for women with a university degree. *Work* was "part-time", "full time" or "no paid job". *Parity* was "nulliparous" or "parous". *Gestational Age* (weeks) was calculated using the expected date of birth and the date of completing the questionnaire, *Pre-pregnancy Body Mass Index* (BMI) was calculated by dividing self-reported pre-pregnancy weight by the self-reported squared height. *Having a weight gain goal* was "yes" or "no". *Smoking* was "non-smoking", "stopped" or "continued". We asked participants report their activity in *seeking information* about pregnancy using a Likert scale (1=very inactive, 7=very active). Dummy variables were computed for categorical variables with more than two levels (*education, work* and *smoking*), with respectively "medium", "part-time work" and "non-smoking" as reference categories.

Pre-pregnancy PA and Change in PA

For this secondary analysis we used pre-pregnancy PA and change in PA. *Pre-pregnancy PA* was measured using the response to a single question measured on a Likert scale (1= very inactive, 7= very active). We further asked: did you change your PA in pregnancy? If a participant responded that she had changed her PA, additional questions about the changes in her PA were asked. We asked questions about four likely reasons for why they changed their PA (tiredness, different needs, to prepare for another lifestyle, for the health of the baby), measured on a Likert scale (1=totally disagree, 7=totally agree). For the women who changed their PA we also offered questions about five types of activities that may have changed (walking, cycling, sports, brief rigorous activities -such as running for the bus or playing with children- and working in house and garden).

Our primary outcome *Change in PA* in pregnancy included three categories: "reduced PA", "maintained PA" and "increased PA". Participants were given one point for every type of activity (walking, biking, sports, brief rigorous activities, working in home and garden) they were *more* active in. They lost one point for every type of activity they were *less* active in. A total score was computed by summing up the scores of all activities, which could range from -5 to +5. Women with a negative total score were categorized as "reduced PA"; women with a null-score and women who reported a priori that they did not change their PA were categorized as "maintained PA". Women with a positive score were categorized as "increased PA".

Motivation, ASE-determinants and barriers

In our questionnaire, we explained "healthy PA" to be moderately intense PA for 30 minutes per day at least 5 times a week before asking related questions. We then asked women to score statements related to: their motivation to engage in healthy PA ("I want to engage in healthy physical activity"), their attitude related to PA in pregnancy (seven items; e.g., "I enjoy to have healthy physical activity in pregnancy"), their social influences related to PA in pregnancy (three items; e.g., "Most people in my environment think it is important that I have healthy physical activity"), and their self-efficacy for PA in pregnancy (three items; e.g., "I manage to have healthy physical activity"). Finally, we asked about pregnancy related barriers to healthy PA (five items; e.g., "I feel too tired to have healthy physical activity"). All of these items were rated on a Likert scale (1=totally disagree, 7= totally agree) and are listed in the result paragraph in Table 4.

Analyses

Our data showed no violation of the assumption of normality. Descriptive statistics were calculated for each of the three subgroups of *Change in PA*: women with reduced PA, maintained PA, and increased PA. Differences in reasons for changing PA were tested with ANOVA-test. Relationships between *pre-pregnancy PA* and *Change in PA* were explored using cross tabulation and Chi-square. Further visual graphs were created for the five subtypes of activities.

Following our model (Figure 1), we performed a multiple linear regression analysis with *motivation for healthy PA* as dependent variable and the seven attitudes, three social influences, and three self-efficacy items as independent variables. We next performed a multinomial logistic regression analysis with *Change in PA* as dependent variable (reduced PA versus maintained PA versus increased PA), and *motivation for healthy PA, self-reported pre-pregnancy PA,* and the five pregnancy-related barriers, as independent variables. We included the following covariates: *age, ethnicity, family income, education, work, parity, seeking information, gestational age, pre-pregnancy BMI, having a weight gain goal* and *smoking*. Probabilities < 0.05 were considered significant.

Results

A total of 950 women agreed to receive information about the study, 475 completed the questionnaire (response rate = 50%). Twenty cases were excluded because they did not meet the inclusion criteria of being healthy pregnant with a defined gestational age. Of the remaining 455 women, 183 reported they did not change their PA. Of the 272 women who reported they changed their PA in pregnancy, twenty women increased the same number of activities as they reduced, so they were also categorised as "maintained PA". In total, 203 (44.7%) women maintained their PA, seventeen (3.7%) women increased their PA and the remaining 235 women (51.6%) reduced their PA (Figure 2).

Please insert Figure 2 and Caption Figure 2

Descriptives for the total group of respondents and three subgroups of *Change in PA* (reduced, maintained, increased) are shown in Table 1. Mean self-reported pre-pregnancy PA was 4.7 (sd 1.2) on a scale of 1 (very inactive) to 7 (very active).

Please insert Table 1

Table 2 shows participants' report of their pre-pregnancy activity in the total group and split up over the primary outcome variable *Change in PA*. In sum, 76 (16.7%) women considered themselves pre-pregnancy as inactive, 130 (28.6%) women as moderately active and 249 (54.7%) as active. Active women reduced their PA more often than moderate and inactive women (Chi-square 48.0378; $p<0.00001$) (Table 2).

Please insert Table 2

Reasons for changing PA are shown in Table 3. Women who did not change PA did not answer these items. The most noticeable differences between the groups were feeling tired and preparing for another lifestyle (Table 3).

Please insert Table 3

Figure 3 provides a detailed picture of the number and percentage of women that changed their PA in relation to their pre-pregnancy PA and the change in PA for each type of activity. Because the group who considered themselves as *very* inactive consisted of only two individuals, these two women were categorised in the inactive group. Increasing PA rarely happened and the greatest reduction was in active sports and brief rigorous activities, including in women who were inactive before pregnancy (Figure 3).

Please insert Figure 3 and Caption figure 3

Table 4 shows the mean scores for motivation to engage in healthy PA, the ASE-determinants related to PA the pregnancy related barriers for the three subgroups. Women who increased their PA, and had a very high motivation. Women who reduced PA had a higher motivation than women who maintained their PA. Women who increased PA seemed to differ from their counterparts who reduced PA in some attitudes, self-efficacy expectations and pregnancy related barriers (Table 4).

Please insert Table 4

Table 5 shows the outcomes of the linear regression model with *Motivation for healthy PA* as dependent variable. Four of the seven attitudes were significant related to motivation, while social influence and self-efficacy were not significantly associated (Table 5).

Please insert Table 5

The number of women with increased PA was too small (n=17; 4.7%) to perform a multinomial regression analysis. Instead, we performed a logistic analysis of "reduced PA" compared to "maintained PA" (Table 6). Pseudo R^2 was .279 and significant determinants were motivation, pre-pregnancy PA, advice to stop PA, pain, tiredness, lack of instruction, age, seeking information and parity (Table 6).

Please insert Table 6

Discussion

We wished to learn how healthy pregnant women change their PA and the reasons associated with a change in PA. More than half of women reduced their PA-level during pregnancy. Only a small minority of our sample increased their PA. In our model (Figure 1), we hypothesized several determinants of the change in PA. Our results partially confirmed our theoretical model for reduced PA.

Positive **attitudes** (e.g., enjoying PA) were, as expected, positively associated with motivation and negative attitudes (e.g. PA is nonsense) were negatively associated with motivation. The most important attitude was "enjoying healthy PA", meaning that PA can likely be promoted by stressing the joy of it. **Social influences** and **self-efficacy** were not associated with motivation. Among Latino women, other researchers found a positive association between social support and levels of PA in pregnancy and post-partum (Thornton, et al., 2006).

Interestingly, having a higher **motivation to engage in healthy PA** was significantly associated with a higher likelihood of reducing PA. We cannot explain this relationship, but we speculate that this may be the result of setting unrealistic goals, or the influence of barriers overruled the influence of the motivation. Although we did not include women with increased PA in our regression analyses, we did notice that women with increased PA also reported higher scores on motivation to engage in healthy PA, and other positive attitudes related to staying active. Further research is needed to understand the factors that interact with motivation to influence level of PA.

High levels of **pre-pregnancy PA** were associated with reduced PA. Our assumption that women would replace their sports in pregnancy by another activity was not confirmed by our data. Women often reduced their PA and rarely increased another type of PA such as walking or biking. This is a

troublesome finding, since an important part of women in childbearing age engage in the recommended amount of PA (WHO, 2014).

As hypothesized, and as found in other studies, **pregnancy related barriers** such as tiredness, pain, and growing belly are associated with a reduction and/or low levels of PA (Connelly, et al., 2015, Jukic, et al., 2012, Leiferman, et al., 2011). Women who reported tiredness or pain were significantly more likely to reduce their PA. Women with higher scores on "it is difficult to achieve healthy PA" were more often found in the group who reduced their PA. Many sports and rigorous activities are difficult to maintain when pregnant because of changing balance, growing belly and perceived risks of hurting the baby (Haakstad and Bo, 2011). Consistent with findings from others, we also found that multiparous women and older women were more likely to reduce their PA (Haakstad, et al., 2009, Juhl, et al., 2012, Owe, et al., 2009).

A serious point of concern in our results is that we found that women who were advised to stop their favourite sport/PA were more likely to reduce their PA. Indeed, it is necessary to stop dangerous sports during pregnancy, however, it is not necessary to reduce PA in general. Pregnant women report they are advised to slow down and they are not told by their care provider that PA is important (Weir, et al., 2010). Antenatal care providers, including midwives, confirm they give low priority to motivating pregnant women to have healthy levels of PA and they often give women advice to slow down (Evenson and Pompeii, 2010, Johnson, et al., 2013, Lindqvist, et al., 2014, Merkx, et al., 2015, Merkx, et al., 2015). Since prenatal PA is associated with better outcomes (Adamo, et al., 2012, Buschur and Kim, 2012, Downs, et al., 2012, Ferraro, et al., 2012, Melzer, et al., 2010, Mudd, et al., 2013), future interventions should aim to increase knowledge in both midwives and pregnant women and should emphasize the importance of healthy PA during pregnancy. Midwives may also advise women to slow down because of their concern about the growing psychological complaints women experience (Fontein-Kuipers, et al., 2014, Lindqvist, et al., 2014). Midwives likely mean slowing down as "de-stressing", but it gets interpreted as "sitting still". Where the first has the intention to empower women to make their own choices, and to listen to their pregnant body, the latter has the intention to sit down and relax physically. Maintaining or increasing PA in pregnancy can in fact help to reduce stress (Battle, et al., 2015, Bogaerts, et al., 2013, Currie, et al., 2013). In this respect slowing down should mean: avoid stress and enjoy PA (Bogaerts, et al., 2013). Further research should be done to verify the extent and consequences of this confusion.

Women with higher scores on **seeking information** regarding pregnancy had a lower likelihood of reducing PA. Consumer information available on various internet sites tells women to maintain PA.

Furthermore, practical ways to maintain or increase PA in pregnancy are given as well as links to professionals providing specific courses for pregnant women in which PA is involved (NISB, 2015) In earlier studies, women expressed an unfulfilled need for pro-active information and support from their care provider (Seefat-van Teeffelen, et al., 2011). Our study shows that pregnant women who seek this information on their own have less reduction in PA.

PA is modifiable (Currie, et al., 2013) and pregnancy is seen as window of opportunity to improve women's health (Midwifery 2020, 2010). We recommend that health professionals pro-actively ask women what their PA level was before pregnancy and encourage women to be physically active in pregnancy. When the kinds of PA women engaged in before pregnancy is not appropriate (e.g., contact sports), women should be encouraged to seek an alternative type of PA. Changing PA requires change of daily life routine, which is not always easy to accomplish (Mailey and McAuley, 2014). Since the midwife is an important source of information and support, she can discuss this issue with pregnant women and suggest options for staying or becoming physical active (Seefat-van Teeffelen, et al., 2011). Despite pain and tiredness, women should be encouraged to sustain or improve their level of PA. Walking and biking can be done very easily during pregnancy. These low cost and easy to follow activities can be introduced as medical prescription for women who have physical complaints of tiredness and pain. Indeed, women tend to follow midwives' advice as this study confirms. Swimming and special courses for pregnant women (e.g., Mom in Balance) are also good options but may incur unaffordable costs. To prevent women reducing their PA, care providers should emphasize the fun of PA and stress its importance, while at the same time providing women with information on how to cope with pregnancy related barriers. Downs et al. call for a paradigm shift in professionals, encouraging them to focus "more broadly on promoting PA before, during and after pregnancy" (Downs, et al., 2012). Since inequity is an important barrier to public health (Gilson, et al., 2007) municipalities and health insurance companies should consider covering the cost of PA sessions for pregnant women.

Strengths and limitations

The strength of our study is that we focussed on healthy pregnant women instead of subgroups like obese or diabetic pregnant women. Healthy pregnant women make up the vast majority of expectant mothers and thus from a public health perspective, this is an important group for preventing illness on the long term.

We are not sure that we captured all types of PA in our outcome measures and we did not have access to a validated questionnaire. Instead, we used the ASE-model, which provided a solid theoretical starting

point for our study. Furthermore we validated our items by using the expertise of our Consortium group of midwives, other health care providers, and researchers.

We used self-reported PA. A self-reported change in PA does not imply that a woman did not meet the activity norm during pregnancy. However, as one third of adult women does not meet the activity norm (WHO, 2015), we assume that PA reduction during pregnancy also implies insufficient PA for a considerable portion of these women. Objective measures of PA would be more accurate, but given the limitations of time and funding we had no valid way to objectively measure PA in pregnant women (Kolt, et al., 2010, Van Poppel, et al., 2010). Longitudinal research before and during pregnancy with more objective measurements is necessary to understand PA in pregnancy more extensively.

Our sample included a relatively small number of women with low levels of education, women who smoked, and non-Dutch women, a problem that frequently occurs in this kind of research (Althuizen, et al., 2009). With those exceptions, our sample is representative of the healthy pregnant Dutch population (PRN, 2013) allowing our findings to be generalised – albeit cautiously - to healthy pregnant women in other Western countries.

Conclusion and clinical implications

More than half of the women in our study reported reducing their PA in pregnancy, mostly in sports and brief rigorous activities. Reduction of PA was seen more in women who considered themselves as active before pregnancy, women who experienced pregnancy-related barriers, women who were advised to reduce their PA and multiparous women. Instead of advising women to slow down when women feel stressed or tired, we recommend that antenatal care providers invest in efforts to stimulate healthy PA, and prevent a reduction of PA in pregnant women. Because women experiencing pregnancy related barriers have more difficulties to have healthy PA, care providers must be competent to address these barriers, and to help women coping with them. An available option is to refer to locally accessible and nice PA programs, with low thresholds (e.g., pregnancy courses that contain a considerable amount of PA for low costs).

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Figure 1. Hypothesized model

Our hypothesized model is based on Attitude-Social Influence-self-Efficacy-Model: Motivation to have healthy Physical Activity (PA) (central in figure) is predicted by attitudes, social influences and self-efficacy. Change in PA in pregnancy is predicted by motivation, self-reported pre-pregnancy PA, activity in seeking information about pregnancy, pregnancy related barriers and covariates.

Figure 2. Participants according to their change in physical activity (PA)

Twenty women were excluded, because they did not meet the inclusion criteria of being healthy pregnant with a defined gestational age.

Figure 3. Change in Physical Activity

Percentages of women who reduced, maintained or increased physical activity (PA) in relation to pre-pregnancy PA are visual in bars for the different type of PA (n=455). The numbers provided in the bars refer to the number of women in that category.