

7

Multidimensional models of prenatal distress in normal risk pregnancy

Anja C. Huizink, Pascale G. Robles de Medina, Edu J.H. Mulder, Gerard H.A. Visser & Jan K. Buitelaar

Submitted

7.1 Abstract

Background: Prenatal stress has been operationalized in numerous ways across studies on the effects of stress during pregnancy on birth outcome and later development. A multidimensional concept of stress is the most likely one to describe what prenatal stress actually is.

Objective: To formulate and test multidimensional models of prenatal stress in a population of normal risk nulliparous pregnant women.

Methods: Self-report data about various aspects of stress-provoking (life events, daily hassles, appraisal of pregnancy and pregnancy-specific anxieties), stress-mediating or -moderating (coping style, social support, neuroticism), and stress-resulting (perceived stress, state-anxiety and general psychological well-being) factors were collected in nulliparous pregnant women in early (n=230), mid (n=217) and late (n=172) pregnancy. Path analysis was performed by means of LISREL 8.30.

Results: In each period of pregnancy a significant multidimensional model of prenatal distress was found which explained most of the variance in the dependent construct of distress (86%, 88% and 94% for early, mid and late pregnancy, respectively). In early pregnancy the best fitting model included direct effects on distress of life events, neuroticism, secondary appraisal of the pregnancy and emotion-focused coping and indirect effect of primary appraisal of pregnancy and a moderating variable daily hassles by available support ($\chi^2 = 26.74$, $df=17$, $p=.06$, $RMSEA=.06$, $RMR=.05$, $CFI=.96$, $NNFI=.92$). In mid-pregnancy the best fitting model included direct effects on distress of life events, neuroticism, daily hassles and pregnancy anxiety, and indirect effects of secondary appraisal of the pregnancy and instrumental support ($\chi^2 = 21.95$, $df=22$, $p=.46$, $RMSEA<.01$, $RMR=.04$, $CFI=1.00$, $NNFI=.99$). In late pregnancy the best fitting model included direct effects on distress of life events, neuroticism, pregnancy anxiety and problem-focused coping and indirect effects of instrumental support and the moderating variable daily hassles by available support ($\chi^2 = 31.58$, $df=17$, $p=.02$, $RMSEA=.07$, $RMR=.05$, $CFI=.97$, $NNFI=.94$).

Conclusion: Each period of pregnancy had some unique aspects that accounted for increased or decreased levels of distress, but life events and especially neuroticism were found to predict distress throughout pregnancy. The multidimensional models of prenatal stress offer more insight into the processes that lead to increased distress levels in pregnant women and may be used to predict birth outcome and postnatal development.

7.2 Introduction

Stress in pregnancy has been associated with premature delivery, reduced birth weight and smaller head circumference in humans (Dunkel-Schetter, 1998; Copper et al., 1996; Lou et al., 1994; Wadwha et al., 1993). Furthermore, animal studies performed under well-controlled conditions have shown deleterious effects of prenatal stress on behaviour and development of the offspring (Schneider, 1992; Schneider & Coe, 1993). In human studies, however, research on severe prenatal stressors has been limited to naturally occurring disasters or stressors during pregnancy, such as war (Rajab et al., 2000), flood (Selten et al., 1999) and major life events (e.g. Newton & Hunt, 1984; Nuckolls et al., 1972). Across these human studies stress has been operationalized in numerous ways, which makes comparison difficult. Results of animal studies are also not readily comparable to results of these varying human studies, since the stressors used in animal studies are of experimentally nature and not comparable to stressors encountered in human pregnancy. Therefore, there is a need for a well described concept of human prenatal stress in order to gain more insight into the complex aspects of human prenatal stress as compared to animal prenatal stress. The purpose of the present study is to develop a multidimensional measurement model of prenatal stress, which could later be incorporated into a biopsychosocial model of birth outcome and postnatal development. To do so, one needs to carefully consider the methodological issues regarding general stress research.

7.2.1 General considerations with regard to stress

For years, the impact of stress on various aspects of health has been assessed with major life changes as stressors. However, the relationship between life event scores and health outcome has been found to be rather modest (e.g. McEwen & Seeman, 1999; Rabkin & Struening, 1976). As an alternative, the focus shifted toward daily hassles, or the ongoing stresses and strains of daily living (DeLongis, et al., 1982). DeLongis et al. (1982) proposed a model in which daily hassles are seen as proximal measures of stress while life events are considered distal. Therefore, hassles should have a more direct impact on health than life events.

Daily hassles, sometimes called minor stressors, may occur simultaneously with major life events. Some researchers have even suggested that hassles could act as an important route of transmission in explaining the effects of major events (Pillow et al., 1996). In a study to identify mediational links between major life events and daily hassles in the stress process, Pillow et al. (1996) tested two alternative models, which can be distinguished in the literature. In the *event vulnerability model*, major life events may sensitize the individual to the occurrence of daily hassles, causing a better remembrance of these minor stressors, which, in addition, are experienced in a surplus negative fashion. On the other hand, the *inoculation model* suggests that exposure to a major stressful life event may reduce the adverse impact of a subsequent negative minor event by means of reduced sensitization to other negative occurrences. Neither of these models could be supported by the results of Pillow et al. (1996). It therefore seems plausible that the effects on health outcome of daily hassles and of life events should be considered independently. Another argument for this view is found in the results of DeLongis et al. (1982). They showed that the effects of life events on health

were only noticeable after a considerable amount of time, whereas the effects of daily hassles on health occurred more rapidly. Therefore, the underlying mechanism by which stress affects health may essentially differ between daily hassles and major life events. Moreover, it has been demonstrated that chronic and daily stressors may be better predictors of subjective and objective health complaints than the more intense but rarely occurring life events (DeLongis et al., 1982; Kanner et al., 1981; Herbert & Cohen, 1993). The many small events of daily life may elevate activities of physiological systems to cause health problems (McEwen & Seeman, 1999). If we expect to find stronger and more direct effects on health of daily hassles, we are confronted with a methodological problem. Changes in levels of hassles may affect health and vice versa, which renders causal interpretation complex. A longitudinal study design in which both aspects are measured repeatedly offers the best possible solution to this dilemma. A study by Dohrenwend et al. (1984) showed that instruments measuring daily hassles may confound stressful circumstances with symptom outcomes. This has also been described as one of the major problematic issues with life events research. This fact should be carefully considered when studying the relationship between daily hassles and health outcome.

7.2.1.1 Social support

With regard to some factors that have been frequently regarded as mediators or moderators in the relationship between stressors and (perceived) distress or health outcome, the role of social support and coping is of special interest. The study of social support has been difficult because various definitions have been used and consensus on the definition of the construct has not been achieved (Heitzmann & Kaplan, 1988). The studies by Caplan (1974) and Cobb (1976) have been frequently cited. Their results emphasize the positive effects of the resources offered by a person's social network on his/her well-being. However, these definitions are not useful because their description of social support is based in fact on the perceived effects of social support (Komproe et al., 1997). Therefore, Komproe et al. (1997) propose the use of the definition of Shumaker and Brownell (1984). This definition describes social support *as an exchange of resources between at least two individuals generally perceived to be intended to enhance the well-being of the recipient (which may actually have positive, neutral and/or negative effects on the recipient's well-being)*. In this view the intention is more important than the actual act or result of social support. A complicating aspect of this definition, however, is that it assumes knowledge of the perceptions of those involved in the interaction. In other words, the intentions of the support provider are assumed to be known. In most studies, social support is judged only from the point of view of the recipient and the intentions of the support provider are ignored. More specifically, most studies only focus on social support when it is perceived by both the recipient and the provider as such, i.e., it is assumed to be helpful by both actors in the interaction and is therefore congruent. However, the perceptions of the provider and recipient with regard to the exchange may also be incongruent when, for example, the provider views his/her support to the recipient as helpful, whereas the recipient perceives the same support as neutral or harmful. Other studies have neglected these possibilities of social support and have only focused on the congruent exchanges. Thus, they view social support only if it is meant and

perceived as helpful. Shumaker and Brownell (1984), on the other hand, emphasize this interactional aspect of social support. In the present study, we do focus on the recipient of social support, for mostly pragmatic reasons. Therefore, by applying the concept of social support as defined by Shumaker and Brownell (1984), we will have to estimate what is generally perceived as the intention of a specific behaviour or interaction.

An issue that has been frequently discussed in the literature is the 'main or buffer effect' of social support. Some researchers state that social support has a main positive effect on health, even in normal situations without stress. Others suggest that only in case of distress, adequate social support would buffer the negative effects on health of this distress. With regard to this controversy, Thoits (1982) describes several methodological issues that should be considered when studying the buffering hypothesis. Most studies suffer from inadequate conceptualization and operationalization of social support. Although some investigators have offered more elaborate conceptual statements (e.g. Cobb, 1976; Kaplan, 1977; House, 1981), efforts to assess the validity and reliability of social support indicators are still noticeably lacking in the literature. Furthermore, most studies have either theoretically or operationally confounded the direct effect of life events upon social support with the interactive (or buffering) effects of events upon support. That is, when examining life-event scales, many important events (like divorce, death of a spouse, marriage) are interpretable as losses or gains of supportive relationships. Moreover, life events may produce additional alterations in the social support system. For instance, divorce may cause other relatives and friends to either increase or reduce their support. Thus, life events can be direct indicators of changes in social support, may cause additional changes in social support, or may exert both effects. Therefore, adequate testing of the buffering hypothesis implies measuring social support repeatedly in a longitudinal design. Again, daily hassles could prove to be less influenced by confounding matters with respect to social support, since most daily hassles do not include changes in social support. Finally, most studies have failed to examine the main effects of social support upon distress but solely investigated the buffer effect. Nevertheless, there are several good reasons to expect a main effect of social support on distress levels. For instance, perception of oneself and one's identity may originate in social interaction and could therefore reflect important aspects of psychological well-being. Furthermore, social support helps to strengthen or maintain self-esteem and could therefore have a direct effect on the psychological state.

7.2.1.2 Coping

Like social support, coping style is another factor to take into account as a possible mediator when studying the relationship between stressors and distress. As we have seen with the concept of social support, it is important to conceptualize clearly what is meant by coping. The word in itself can be confusing in that coping means literally "successfully dealing with the circumstances." However, one could argue that attempts to cope are a way of coping as well. Therefore, we apply the definition of Lazarus & Folkman (1984) which states that coping includes *the efforts, both action oriented and intra-psychic, to manage environmental and internal demands and conflicts among them, which exceed a person's resources*. Coping has been differentiated in, among others, the dimensions of problem-focused coping and

emotion-focused coping, both of which have been found to be related to psychological well-being (Bruder?Mattson & Hovanitz,1990). Strategies of problem-focused coping refer to a task-orientation, like solving a problem, reconceptualizing it, or minimizing its effects. Emotion-focused coping, on the other hand, refers to a person-orientation that may include emotional responses, self-preoccupation, and fantasizing reactions (Endler & Parker, 1993). Another coping dimension, avoidance, is sometimes identified, and may include either person-oriented or task-oriented strategies. Avoidance is not a successful way of coping in a long-term perspective but can reduce stress levels at short term, by avoiding the situation that causes stress. Coping has also been considered an important determinant of social support (Billings & Moos, 1981). For instance, people who use avoidance coping responses have fewer social resources. From a coping point of view, social support is conceptualized as a resource of coping strategies. For example, one can use other persons as a source of emotional regulation in the service of emotion-oriented coping. Thus, coping could have moderating effects on the relationship between social support and physical well-being. In addition, coping strategies would appear to mediate between stressful events and psychological distress.

Besides the effect of social support and coping on distress, personality traits such as neuroticism have also been found to be strong predictors of levels of distress. Neuroticism, or negative emotionality, has been associated with a stronger susceptibility to psychological distress and with increased vulnerability to stress-provoking factors. Individuals with higher negative emotionality also have a tendency to have unrealistic ideas and inefficient ways of coping with stress. It has also been suggested that people who score high on negative affectivity seem to be particularly sensitive to minor failures, frustrations, and irritations of daily life (Watson & Clark, 1984). Thus, personal characteristics could have mediating or moderating effects on the distress response to life events or daily hassles or could perhaps even have a direct influence on distress. Moreover, neuroticism could bias the amount of recollected minor or major stressful events.

All abovementioned methodological issues should be considered carefully when studying the effects of stress on health outcome.

7.2.2 Prenatal stress

With this information in mind and aware of the methodological pitfalls involved in stress research, we tried to apply this knowledge to the literature on prenatal stress. Since our future aim is to analyze the effects of prenatal stress on the fetus, birth outcome, and later child development and behavior, it is important to conceptualize precisely what is meant by prenatal stress.

A multidimensional concept of stress is the most likely one to describe what prenatal stress actually is. Such a concept should involve various aspects of stress. As a theoretical starting point, it is useful to incorporate the model of Lazarus and Folkman (1984), in which a differentiation is made between stress-provoking factors, stress-mediating or -moderating factors, and stress-resulting factors. With regard to stress-provoking factors, major life events and daily hassles are assumed to potentially provoke a stress reaction. As we have learned from the general stress literature, daily hassles have some advantages over life

events, because they hold more potential for modification, intervention, or prevention than do life events, which are sometimes unavoidable.

Mediating factors are factors that may interact with the effect of stress-provoking factors on stress-resulting factors. As outlined by Baron and Kenny (1986), a mediator represents the generative mechanism through which the independent variable is able to influence the dependent variable of interest and that, in statistical terms, accounts for the relation between the independent and dependent variable. In contrast, a moderator modifies the strength of the relation between the independent and dependent variables. Social support, coping style, and personality factors are such factors that may either increase or decrease the effect of a life event or daily hassles on the amount of stress that an individual perceives. For instance, in their review of controlled trials of enhanced social and psychological support in pregnancy, Elbourne et al. (1996) concluded that social support has a number of beneficial psychological and behavioural effects on the pregnant woman. Pregnant women receiving social support were less likely than controls to feel unhappy, nervous, and worried during pregnancy. Thus, social support might have an indirect effect on birth outcome by reducing stress or anxiety levels. When these factors are also taken into account, a more informative concept of stress is formed.

Stress-resulting factors are generally reflected as the amount of stress an individual actually perceives or reports. Thus, subjective feelings of stress are part of the stress-resulting factors of the model of Lazarus and Folkman. This is also known as distress.

Recent studies (Sheehan, 1998; Sheehan, 1996; Lobel & Dunkel-Schetter, 1990) have integrated the various stress definitions into a comprehensive and robust multidimensional definition of prenatal stress. The results of Lobel and Dunkel-Schetter (1990) showed that the construct of prenatal distress was best predicted by combining life events distress, perceived chronic distress, and state anxiety. In other words, appraisal and emotion may be central components of distress. Sheehan (1996; 1998) created a measurement model that included socio-economic stressors, family stressors and support as part of the prenatal stress concept. These stressors are environmental factors, unlike the stressors in the study of Lobel and Dunkel-Schetter (1990) which appeared to be personality factors. Although either model is multidimensional, an overall model combining both environmental and personality factors may prove to be a more complete model of prenatal stress. Personality aspects, like neuroticism, coping style, and available or perceived social support may moderate or mediate the effects of stress provoking factors on the amount of perceived distress. Although both Sheehan (1996; 1998) and Lobel and Dunkel-Schetter (1990) do mention these potentially mediating or moderating factors, these factors were not included in their models of prenatal stress.

We previously showed that coping changes during pregnancy (Huizink et al., 2000b). Overall, pregnant women tended to prefer emotion-focused coping styles. However, the effectiveness of coping in reducing distress also changed throughout pregnancy. A negative association between emotion-focused coping and distress was found only in early pregnancy, whereas problem-focused coping was related to reduced levels of distress in mid and late pregnancy. The same temporal specificity may apply to the possibly moderating function of social support. Thus, it is important to test the multidimensional construct of prenatal stress at various moments of pregnancy. Therefore, data on stress-related factors were collected three times during pregnancy in the present study.

7.2.3 The model of prenatal stress to be tested in

the present study

In this study, we formulated a multidimensional model of distress in pregnancy, which is shown in Figure 7.1. Distress is determined by a combination of questionnaires which assess the perceived feelings of stress. General stress-provoking factors included the impact scores of life events and the frequency of daily hassles. The impact score of life events was assumed to have an effect independent of daily hassles. In addition, the appraisal of pregnancy will be included as a stress-provoking factor. Primary appraisal of pregnancy indicates whether or not the event of pregnancy itself is regarded as a threat. Secondary appraisal describes the amount of control one perceives to have over the course of pregnancy. Both aspects of appraisal of pregnancy may potentially provoke a stress response. For instance, when pregnancy is regarded as an unpleasant event, perhaps due to physical symptoms involved with pregnancy or to relational problems with the father of the child, pregnancy itself is a stressor. In addition, the uncontrollableness of all changes involved with pregnancy may give rise to increased distress. This was indeed found in a previous study (Huizink et al., 2000a), which also showed effects of primary appraisal of pregnancy on distress.

Likewise, anxieties specifically related to pregnancy have been shown to increase levels of distress (Huizink et al., 2000a). In particular, increased levels of fear of giving birth and fear of bearing a physically or mentally handicapped child resulted in increased levels of general distress. Therefore, we included these pregnancy-specific anxieties as potentially stress-provoking factors in our model.

With regard to potentially mediating or moderating factors, we included both direct and indirect effects of social support on distress in our multidimensional model of prenatal stress. We hypothesized that various aspects of social support may be effective in pregnant women. First of all, the perceived available social support may have a direct or buffering effect on distress. Secondly, the received emotional and instrumental support may be of particular relevance in this study. Previous studies on coping in pregnancy (Huizink et al., 2000b) showed that pregnant women preferably use emotional coping strategies. Emotional social support may be a source for this coping strategy. Moreover, since pregnancy also involves physical changes that may result in less mobility, instrumental support may be especially appreciated in this period of life.

Another potentially moderating effect is expected of neuroticism, for which a main effect is formulated in our model.

In order to gain more insight into the concept of prenatal stress, we formulated and tested a multidimensional model of prenatal stress in early, mid-, and late pregnancy in a sample of normal risk pregnant women, including the aforementioned factors. The distress model based on the aforementioned general and pregnancy-specific considerations with regard to the various factors involved with stress is presented in Figure 7.1.

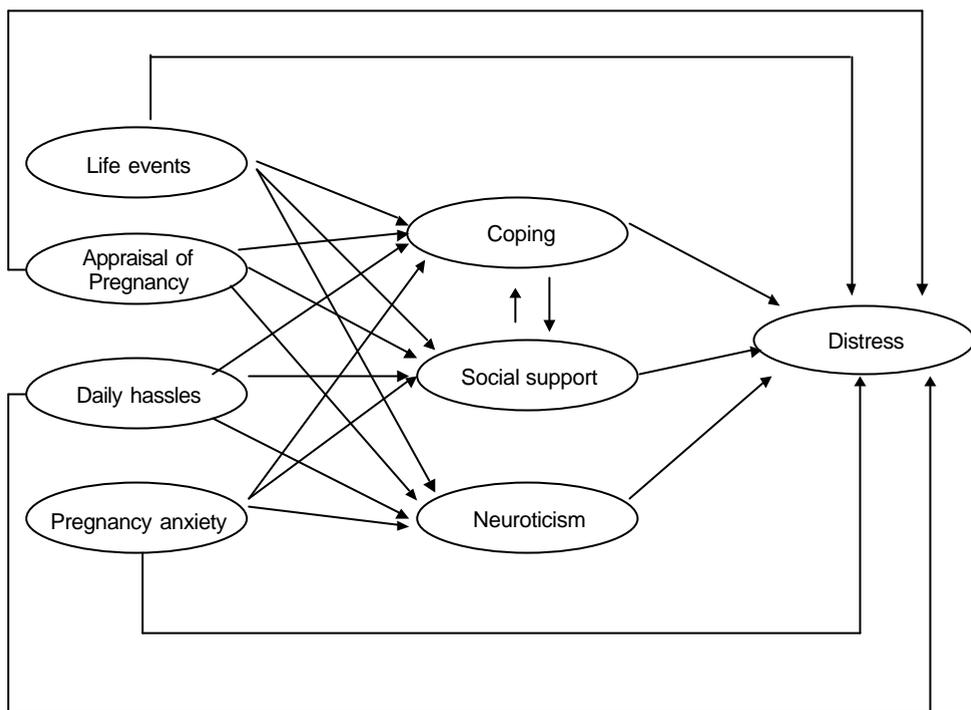


Figure 7.1. Theoretical path model to be tested with LISREL.

From this model, we could specify more specific hypotheses to be tested, which were based on findings of a previous study on the mediating role of coping in a multidimensional model of distress (Huizink et al., 2000c). The general aims to be examined in the present study were:

1. To formulate and test a multidimensional model of prenatal stress cross-sectionally in early, mid- and late pregnancy, including environmental and personality factors;
2. To analyze the different effects of the predictors of prenatal stress in early, mid-, and late pregnancy;
3. To test for longitudinal effects on prenatal stress of stress-provoking factors.

7.3 Methods

7.3.1 Participants

All participants in this study were included in a larger prospective longitudinal project which also investigated the influence of prenatal psychosocial factors on fetal behavior and the postnatal development of the children. Subjects were recruited from a consecutive series

of referrals to the Outpatient Clinic of the Department of Obstetrics of the University Medical Center Utrecht (UMCU), which is a first-line referral center for low-risk pregnancies with responsibilities for mid-wives as well, between January 1996 and July 1998. The UMCU is located outside the city of Utrecht and attracts a mixed rural and urban population of patients. From a total of approximately 650 invited women, 230 agreed to participate. The main reason for refusing to participate was the time-consuming aspect of the study. The study was approved by the ethical committee of the UMCU; participation was on a voluntary basis but written informed consent was required. Only nulliparous women with a singleton pregnancy were included. Characteristics of participants did not differ from those of non-participants, except in the case of women with full-time jobs, who were less likely to participate. The descriptives of the participants are summarized in Table 4.1. As shown, the sample of participants consisted largely of middle class women, although both lower and higher social classes were represented. The majority of women (92.4%) lived together with their partner, either in wedlock or unmarried. Furthermore, at the time of their inclusion in the study, the majority of women had a paid job, 54.2 % working less than 38 hours a week and 45.8 % working full-time.

Participants were asked to fill out questionnaires three times during pregnancy; at 15-17 weeks (early pregnancy), 27-28 weeks (mid pregnancy), and 37-38 weeks of gestation (late pregnancy). Of the 230 women who completed the questionnaires on the first occasion, 217 completed the questionnaires on the second occasion and 172 did so on the third occasion. The main reason for the drop in the number of participants towards late pregnancy was delivery before 37 weeks of gestational age or delivery before the last session of data collection, which was planned near term, had taken place; other reasons were lack of interest, lack of time, stillbirth, pregnancy complications that required intensive follow-up, or relocation to another city.

7.3.2 Questionnaires

The package of questionnaires was composed to measure stress-provoking aspects, potential stress-mediating or -moderating factors and stress-resulting aspects.

Stress-provoking factors were assessed by means of a life events questionnaire and a daily hassles list. Also, pregnancy-related anxieties and primary and secondary appraisal of pregnancy were determined.

Life events were assessed with the Life Events Questionnaire (Vragenlijst meegemaakte gebeurtenissen; Willige van de et al., 1985). The life events impact score of this questionnaire was used, which was based on the Social Readjustment Rating Questionnaire (Holmes & Rahe, 1967).

Daily Hassles were assessed by means of the Everyday Problem Checklist (Alledaagse Problemen Lijst) (Vingerhoets et al., 1989). The daily hassles questionnaire used in this study is a Dutch translation of a selection of items of questionnaires, including the Daily Hassles Scale (Kanner et al., 1981), the Everyday Problem Scale (Burks & Martin, 1985) and the Daily Life Experience Questionnaire (Stone & Neale, 1982). It measures the frequency of daily hassles in the past month and gives an intensity score which is the subjective experience of the participant of the unpleasantness of the hassles. In this study, only the frequency score was used in

order to stay free from confounding stress-provoking with stress-resulting factors in the intensity score.

Pregnancy anxieties were assessed by means of the Pregnancy Related Anxieties Questionnaire-Revised (PRAQ-R). Specific fears and worries related to pregnancy were measured on each occasion by means of an abbreviated version of the PRAQ developed by Van den Bergh (1990). A previous study showed that three different fears specifically related to pregnancy could be measured by using three items per subscale: fear of giving birth, fear of bearing a physically or mentally handicapped child, and concern about one's appearance (Huizink et al., 2000a). This questionnaire was filled out in early, mid and late pregnancy. Cronbach's alpha's of the subscales were all > .76 throughout pregnancy.

The appraisal of pregnancy was measured by two single-item instruments. The perceived threat of the situation, or primary appraisal, was measured by the question 'Can you indicate on a ten-point scale the degree to which your pregnancy relates to the most upsetting (=1) and most pleasant event (=10) in your life? Secondary appraisal, or the perceived options to control the situation, was assessed with the question 'To what extent do you think you are able to influence the course of your pregnancy? Participants could answer on a 5-point scale ranging from 'considerably' to 'not at all'. These two items were answered on each occasion.

Information on potential **stress-mediating or -moderating factors** was gathered on each occasion by means of questionnaires on social support, coping behavior, and a general personality factor. *Social support* questionnaires included two subscales of the Social Provisions Scale (SPS; Russell and Cutrona, 1984; Cutrona and Russell, 1987) which have been translated into Dutch (Komproe et al., 1991), and two subscales of the Social Support List-Interactions: emotional and instrumental support (SSL-I; Sonderen, 1991, 1993). The two subscales of the SPS measured the perceived available emotional and instrumental support. Each subscale contains four items, with two of them worded in a positive direction and two worded in a negative direction. Respondents indicate on a four-point scale the level of (dis-) agreement with the statements. Cronbach's alpha's of the subscale emotional support were moderate (.66 - .68). However, Cronbach's alpha's of the subscale instrumental support in this study were < .60 and therefore not appropriate for further analysis (Cronbach, 1951). Since the SPS questionnaire has never before been used in a sample of pregnant women, we performed a confirmatory factor analysis (CFA) by means of LISREL 8.30* to test if a single factor could be found in our sample, instead of two separate factors. The results showed that four items indicated a latent factor 'available support' best in early and mid pregnancy (Appendix 1). Four other items were removed due to high error variances (>.75). The Cronbach's alpha of this factor was .78 in early pregnancy and .63 in mid pregnancy. In late pregnancy, a slightly different factor solution was found, including three items that fitted the data best (Appendix 1). The Cronbach's alpha of this factor was .89. These factor scores were included in further analyses. The two subscales of the SSL-I assessed received emotional and instrumental support, and both measure the frequency of supportive interactions. The subscale emotional support consists of eight items and that of instrumental support consists of seven items. A four-category response format was used, ranging from 'hardly ever or never' to 'very often'. Cronbach's alpha's of the subscales in this study were .91 for emotional support throughout

* The CFA showed the following results. In early pregnancy: $\chi^2 = 1.36$, $df=2$, $p = .50$, $RMSEA < .005$, $RMR = .02$, $CFI = 1.00$, $NNFI = 1.00$. In mid pregnancy: $\chi^2 = .13$, $df=2$, $p = .94$, $RMSEA < .005$, $RMR = .007$, $CFI = 1.00$, $NNFI = 1.00$. In late pregnancy: $\chi^2 = .12$, $df=2$, $p = .95$, $RMSEA < .005$, $RMR = .006$, $CFI = 1.00$, $NNFI = 1.00$. These results indicate good fits of the models.

pregnancy, and .83, .77 and .79 for instrumental support in early, mid, and late pregnancy, respectively.

Coping style was assessed by means of the 'Utrecht Coping List-19' (Schreurs, 1988), which is an abbreviated form of the 'Utrecht Coping List-30'. It contains 19 items to be answered at a 5- point scale. A previous confirmatory factor analysis of this questionnaire in the same sample of pregnant women, showed the presence of two coping factors: emotion-focused coping and problem-focused coping. Only three items per factor were needed to predict these coping styles accurately (Huizink et al., 2000b) and were used in the present study. They were determined on each occasion during pregnancy.

Trait anxiety was assessed by means of the State-Trait Anxiety Inventory (STAI). The STAI (Spielberger et al., 1970) comprises two self-report scales for measuring two distinct anxiety concepts, state-anxiety and trait-anxiety. Both scales contain 20 statements that ask the respondent to describe how she feels at a particular moment in time (state-anxiety) or how she generally feels (trait-anxiety). State anxiety is conceptualized as a transitory emotional state, whereas trait-anxiety refers to relatively stable individual differences in proneness to anxiety. Cronbach's alpha in this study was .88 for state anxiety and .83 for trait anxiety. The STAI was filled out on each occasion. A subgroup of 159 pregnant women also filled out a neuroticism questionnaire (ABV-N; Wilde, 1963). Trait anxiety and neuroticism appeared to be highly significantly correlated ($r > .80$, $p < .005$). Therefore, we preferred to label 'trait anxiety' as neuroticism throughout the present paper.

Stress-resulting factors involved a perceived stress scale, a general index on mental well-being, and state-anxiety.

State-Trait Anxiety Inventory (STAI). The STAI (Spielberger et al., 1970) as described above was used to assess state anxiety three times during pregnancy.

General Health Questionnaire (GHQ-30; Goldberg, 1972). A Dutch translation of the GHQ-30 (Koeter & Ormel, 1991) was used to measure psychological well-being of our subjects. The questionnaire contains 30 questions to be answered on a four-point scale. This questionnaire was filled out on each occasion.

Perceived Stress Scale (Vragenlijst Ervaren Stress). Perceived stress was assessed by means of a Dutch translation of the Perceived Stress Scale of Cohen & Williamson (1987). It contains 14 items on an individual's perceived stress over the last month to be answered on a 4-point scale, ranging from 'never' to 'always'. This questionnaire was filled out on each occasion.

The dependent variable in this study is a latent construct distress, composed of the three abovementioned questionnaires. Thus, distress is the outcome variable in the recursive path model. The three indicators showed high intercorrelations ($r > .60$). Moreover, Cronbach's alpha of the items of all three questionnaires was $> .90$.

7.3.3 Statistical approach

The predictors of distress in the multidimensional model were examined by means of path analyses with LISREL 8.30, a structural equation modeling technique (Jöreskog & Sörbom, 1993; Byrne, 1998). In our path model, the latent construct distress was composed of three indicators (GHQ-30, PSS, State-anxiety) and predicted by various aspects of stress provoking factors (daily hassles, life events, primary and secondary appraisal of pregnancy, fear of giv-

ing birth, fear of bearing a physically or mentally handicapped child, and concern about one's appearance), two aspects of coping (emotion-focused coping and problem-focused coping), three aspects of social support (available support, received emotional support, and received instrumental support) and one personality characteristic (trait anxiety).

Various steps were undertaken in the statistical analyses. First, descriptive analyses were performed, yielding mean and standard deviations and Pearson correlation coefficients between the dependent variable and the predictors. The results of these analyses gave some insight into the correlational structure, which was further elucidated with cross-sectional path analyses of distress. Finally, longitudinal analyses were performed.

In more detail, cross-sectional analyses included several steps. First, a basic path model was postulated in each period of pregnancy according to previous findings (Huizink et al., 2000b) and tested with LISREL. Included in this model were direct (main) effects on distress of various aspects of social support and personality. Second, moderating effects of social support were tested in a next model. Model fits of the first and second models were determined. Finally, a more complex model was formulated, according to the findings and modification indices offered by LISREL of the first two models. The best fitting model will then be presented.

Longitudinal analyses also involved several steps. First, it was tested if predictors of distress in early pregnancy could also predict distress in mid-pregnancy directly or indirectly by means of the distress level in early pregnancy. The same step was made for the predictors of distress in mid-pregnancy and the distress level in late pregnancy. A next step tested if the cross-sectional model of distress could be improved by adding the distress level found in the preceding period of pregnancy.

The goodness of fit between the hypothesized path model and the sample data was subsequently tested for each model. This provided information about the reliability and validity of the model while taking measurement errors into account. Goodness of fit measures used were chi square (χ^2) and chi-square divided by degrees of freedom. The latter is sensitive to sample size and is therefore regarded as a measure of fit rather than a test statistic. When chi-square is divided by its degrees of freedom the result should be less than 3 if it is to indicate a reasonable fit to the data. P-values of the Chi-square statistic should be $> .05$, thus indicating that the model is not significantly different from the data. Other fit criteria include: Comparative Fit Index (CFI ; $> .9$ indicates a good fit), Non-Normed Fit Index (NNFI; $> .9$ indicates a good fit), Root Mean Square Error of Approximation (RMSEA), which should be at least less than $.08$ and Root Mean Square Residual (RMR), which should be less than $.05$ (Jöreskog & Sörbom, 1993; Byrne, 1998).

When several a priori nested models are tested, the models' Akaike's Information Criterion (AIC) can be compared among the models; the lowest value indicates the best model. In addition, the difference between chi-square can be tested for significance.

7.4 Results

7.4.1 Descriptive analyses

Means and standard deviations were calculated for all predictors and depending variables and their correlation coefficients are presented in Tables 7.1 and 7.2.

Table 7.1 Means (standard deviations) of the stress-provoking, stress-mediating, and stress-resulting factors on three occasions in pregnancy

Predictors	Early pregnancy	Mid-pregnancy	Late pregnancy
<i>Daily hassles</i>	10.2 (6.4)	7.8 (5.5)	6.4 (4.4)
<i>Impactscore Life Events</i>	301.9 (138)	164.4 (114)	150.4 (106)
<i>Emotion-focused coping</i>	8.7 (1.8)	8.0 (1.9)	8.1 (2.2)
<i>Problem-focused coping</i>	8.0 (1.9)	8.0 (1.9)	7.7 (2.0)
<i>Available support</i>	14.8 (1.9)	14.7 (1.6)	10.9 (2.5)
<i>Emotional support</i>	18.5 (4.4)	19.0 (4.4)	18.2 (4.5)
<i>Instrumental support</i>	14.0 (3.9)	13.8 (3.4)	13.4 (3.5)
<i>Trait anxiety</i>	35.7 (9.1)	34.4 (9.3)	33.7 (8.9)
<i>GHQ-30</i>	4.6 (5.0)	4.9 (5.0)	5.4 (4.8)
<i>State anxiety</i>	32.9 (7.8)	31.4 (7.3)	31.1 (8.4)
<i>Perceived Stress Scale</i>	28.1 (5.5)	28.1 (5.9)	27.0 (5.5)

Table 7.2 Pearson correlations between distress and stress-provoking and -mediating factors

Predictor	Distress T1			Distress T2			Distress T3		
	T1	T2	T3	T1	T2	T3	T1	T2	T3
<i>Daily hassles</i>	.30**	.28**	.32**	.28**	.37**	.36**	.19*	.33**	.41**
<i>Life events</i>	.32**	.18*	.19*	.26**	.28**	.25*	.32**	.32**	.34**
<i>Emotion-focused coping</i>	-.27*	.15*	-.21*	-.17*	.18*	n.s.	-.18*	n.s.	n.s.
<i>Problem-focused coping</i>	n.s.	-.22*	n.s.	n.s.	-.18*	n.s.	n.s.	n.s.	n.s.
<i>Available support</i>	-.25**	-.29**	n.s.	-.19*	-.30**	n.s.	n.s.	-.36**	n.s.
<i>Emotional support</i>	.21**	n.s.	n.s.	.16*	.26**	.22*	n.s.	n.s.	.20**
<i>Instrumental support</i>	.16*	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
<i>Trait anxiety</i>	.72**	.60**	.55*	.62**	.82**	.72**	.54**	.60**	.79**
<i>Primary appraisal</i>	-.25**	-.16*	-.24*	n.s.	-.20*	-.25*	-.19*	n.s.	-.28**
<i>Seconarcy appraisal</i>	.20**	.25**	.22*	n.s.	.28**	.22*	n.s.	n.s.	n.s.
<i>Fear of giving birth</i>	.21**	.26**	.21*	.21*	.28**	.26**	.21*	.30**	.34**
<i>Fear of handicapped child</i>	.25**	.38**	.37**	.35**	.49**	.49**	.25**	.38**	.48**
<i>Concern for appearance</i>	.24**	.27**	.33**	.22*	n.s.	.32**	.35**	.28**	.27**

T1 = early pregnancy; T2 = mid-pregnancy; T3 = late pregnancy * : p < .05; ** : p < .005; n.s. = not significant

The impactscore of life events and the frequency of daily hassles (stress-provoking factors) decreased by almost 50% in the course of gestation (Table 7.1). In early pregnancy, many women encountered life events associated with being pregnant, such as marriage, changing houses, changes in the financial situation, and changes in the relationship with the partner. Later in pregnancy, pregnant women had less quarrels with their partner or with other family members. In contrast, the GHQ-30 score slightly increased, whereas state-anxiety and perceived stress hardly changed. The latter three are all indicators of the dependent variable. Thus, despite the decrease in some stress provoking factors, the amount of distress remained rather stable.

7.4.2 Cross-sectional analyses

7.4.2.1 Early pregnancy

Previously we showed that direct effects on distress exist of daily hassles, life events, and secondary appraisal of the pregnancy in early pregnancy (Huizink et al., 2000b). In addition, a mediating effect was found of emotion-focused coping for the distress response to the uplift of pregnancy (primary appraisal). These paths were included in the present basic path model. Direct effects on distress of available support, received emotional and instrumental support and anxious personality were initially added to this model. This model did not fit the data well and no direct effects of available or received support were found. In contrast, there was a strong direct effect of neuroticism on the level of distress. An alternative model was postulated including moderating effects of available support and received emotional and instrumental support for daily hassles and life events. None of these moderating variables contributed significantly to the level of distress. Therefore, a more complex model was formulated in which the effects on distress of the moderating variables daily hassles by available support and life events by available support were mediated by emotion focused coping. The path of the moderating variable life events by available support to emotion focused coping was not significant. The remaining best fitting model ($\chi^2 = 26.74$, $df=17$, $p= .06$, $RMSEA=.06$, $RMR = .05$, $CFI= .96$, $NNFI=.92$) is presented in Figure 7.2 and explained 86% of the variance of the latent construct distress. The model included both direct and indirect effects. Increased levels of the impact score on life events, a more anxious personality ('neuroticism'), and regarding pregnancy as a largely uncontrollable event resulted in increased levels of distress. The uplift of pregnancy resulted in increased emotion focused coping. When daily hassles were accompanied by available support in one's surroundings, increased emotion focused coping strategies were also found. In turn, the latter resulted in decreased levels of distress. The direct effect of daily hassles on distress was no longer significant when the moderator daily hassles by available support was included in the model. Specific pregnancy-related fears did not play a significant role in early pregnancy.

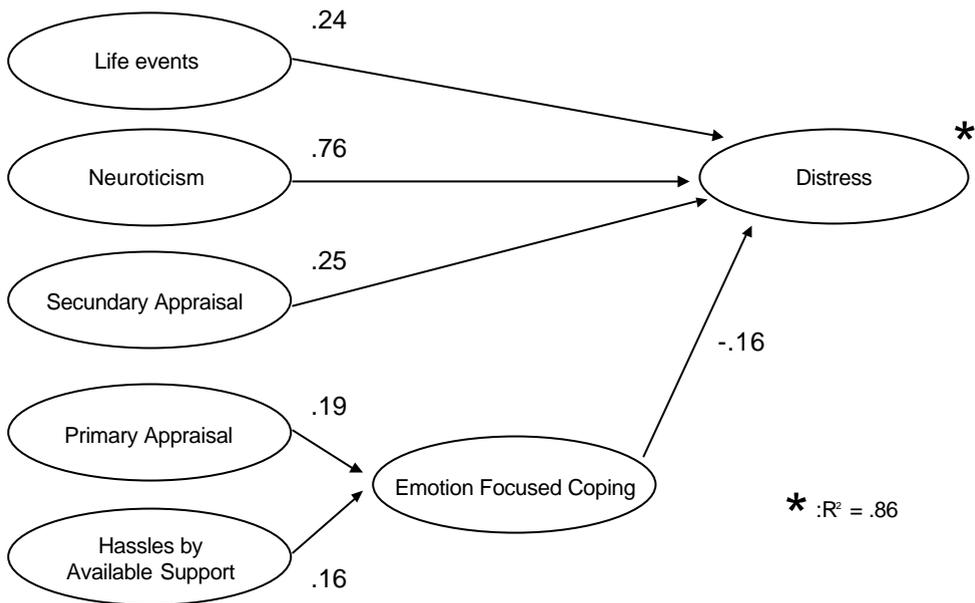


Figure 7.2 Best fitting model of distress in early pregnancy. The numbers above the arrows reflect the standardized Beta coefficients.

7.4.2.2 Mid pregnancy

The basic path model of distress in mid-pregnancy included direct effects of daily hassles and life events on distress. Secondary appraisal was related to increased levels of fear of giving birth and fear of bearing a physically or mentally handicapped child, which in turn were associated with increased levels of distress (Huizink et al., 2000b). First, direct paths of available, received instrumental and emotional support, and neuroticism to distress were added to this model. No significant direct effects of social support on the level of distress were found. Neuroticism was positively related to the level of distress. Second, the proposed direct effects of social support were replaced by moderating effects of the various aspects of social support for daily hassles and life events. None of these moderating variables contributed significantly to the prediction of distress. Finally, we hypothesized in a more complex model that received instrumental and emotional support would reduce the levels of pregnancy-specific anxiety, which in turn would decrease the level of distress. Instrumental support was found to significantly reduce the fear of giving birth and the fear of bearing a physically or mentally handicapped child, thereby indirectly reducing the level of distress. No such effect was found for received emotional support in mid-pregnancy. This model fitted the data well ($\chi^2 = 21.95$, $df=22$, $p= .46$, $RMSEA<.01$, $RMR = .04$, $CFI= 1.00$, $NNFI=.99$) and accounted for 88% of the total variance of distress. The model is shown in Figure 7.3.

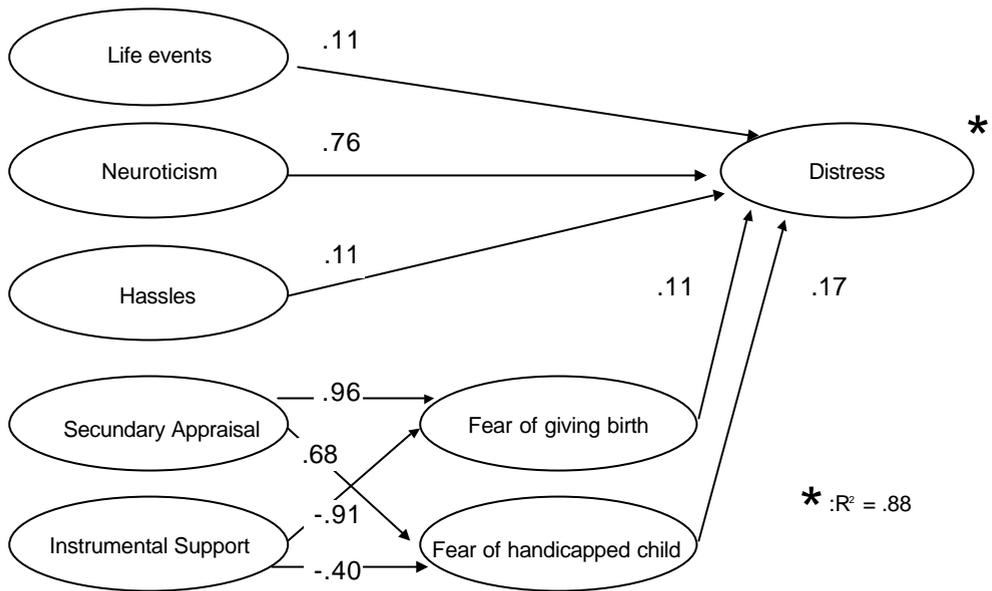


Figure 7.3. Best fitting model of distress in mid-pregnancy.

7.4.2.3 Late pregnancy

The basic path model of distress in late pregnancy included direct effects on distress of daily hassles, life events, problem-focused coping and fear of bearing a physically or mentally handicapped child (Huizink et al., 2000b). As a first step, direct effects of social support and neuroticism on distress were added to this model. Neuroticism showed a significant effect on distress, whereas no significant direct effects were found for available and received social support. The direct effects of social support were therefore replaced by moderating effects of social support by daily hassles or by life events in the next model. None of these moderating variables was found to be a significant predictor of distress. A complex final model was postulated, according to our hypotheses that received instrumental support would increase problem-focused coping and that daily hassles by available support would also increase the level of problem-focused coping, which in turn would lead to reduced levels of distress. This model showed a good fit to the data ($\chi^2 = 31.58$, $df=17$, $p=.02$, $RMSEA=.07$, $RMR = .05$, $CFI= .97$, $NNFI=.94$) and accounted for 94 % of the total variance of distress in late pregnancy. The model is presented in Figure 7.4.

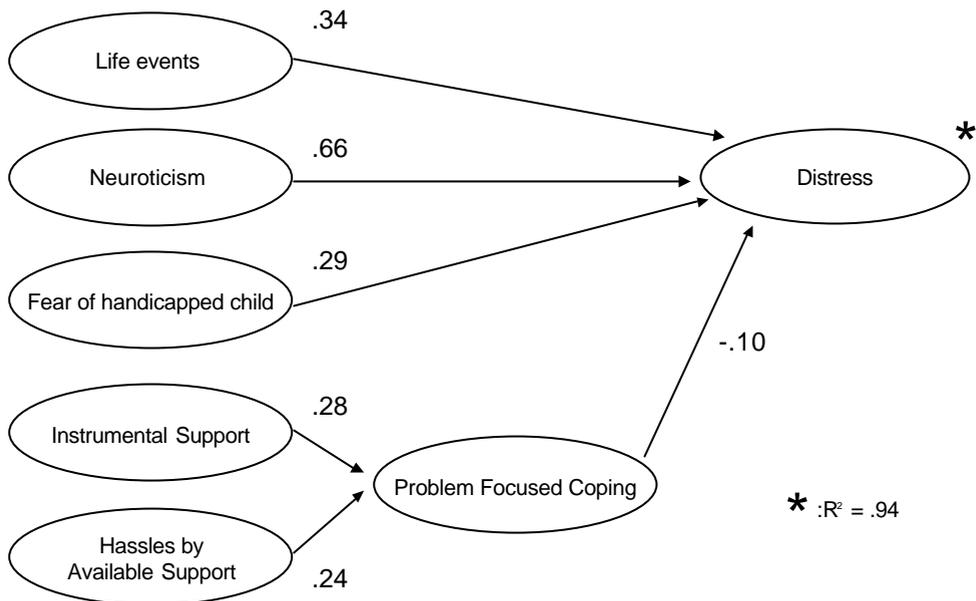


Figure 7.4. Best fitting model of distress in late pregnancy.

7.4.3 Longitudinal analyses

To test for longitudinal effects of potentially stress provoking factors on distress, several steps were undertaken. First, correlation coefficients between the distress scores in early, mid- and late pregnancy were found to be moderately high ($r > .57$) and statistically significant ($p < .0005$). Second, predictors of distress in early pregnancy (see Figure 7.2) were postulated as predictors of distress in mid-pregnancy in a path model and tested with LISREL. The results showed that neuroticism, secondary appraisal of pregnancy, and life event impact scores determined in early pregnancy accounted for 63 % of the distress in mid-pregnancy. All these paths were significant ($t > 2$) and the model fit was found to be adequate ($\chi^2 = 18.17$, $df=17$, $p = .38$, $RMSEA = .03$, $RMR = .06$, $CFI = .99$, $NNFI = .98$). Third, secondary appraisal of pregnancy and the life event impact scores determined in early pregnancy were added to the cross-sectional predictors of distress in mid-pregnancy (see Figure 7.3). Although neuroticism determined in early pregnancy contributed significantly to distress in mid-pregnancy, this variable was not added to the cross-sectional model, because neuroticism in early and mid-pregnancy were strongly correlated ($r = .76$, $p < .0005$). They cannot be regarded as independent predictors and, therefore, reflect a relatively stable characteristic of an individual. When the cross-sectional predictors were entered in the model, the longitudinal effects of secondary appraisal of pregnancy and the life event impact scores were no longer significant. Fourth, cross-sectionally determined predictors (see Figure 7.3) and distress scores of early pregnancy were postulated as predictors of distress in mid-pregnancy. Distress in early pregnancy did not significantly contribute to the variance of distress in mid-pregnancy when the

cross-sectional predictors of distress in mid-pregnancy were taken into account. Finally, according to the modification indices offered by LISREL, two paths were added to the latter model. Distress in early pregnancy was found to be related to increased fear of giving birth and fear of bearing a physically or mentally handicapped child (see Table 3). This model fitted adequately to the data ($\chi^2 = 48.07$, $df=44$, $p=.31$, $RMSEA=.03$, $RMR = .05$, $CFI= .98$, $NNFI=.96$), although the fit is not optimal. When we compared this longitudinal model with the cross-sectional model in Figure 7.3, the latter is preferred according to the AIC criteria (142.07 versus 87.95) and according to the CFI (.98 versus 1.00) and NNFI (.96 versus .99).

Similar steps were followed to test the longitudinal effects on distress in late pregnancy of stress provoking factors determined in mid-pregnancy. The first step involved predictors of distress in mid-pregnancy (see Figure 7.3) as potentially stress-provoking factors for distress in late pregnancy. This model showed no satisfactory fit to the data. However, the paths from the life event impact scores and neuroticism determined in mid-pregnancy to distress in late pregnancy were found to be significant ($t > 2$). However, when the cross-sectional predictors of distress in late pregnancy (see Figure 7.4) were taken into account, these factors from mid-pregnancy were no longer significant predictors of distress in late pregnancy. The second step included stress-provoking factors from late pregnancy and distress scores of mid-pregnancy as predictors of distress in late pregnancy. Distress in mid-pregnancy did not significantly contribute to the variance of distress in late pregnancy.

7.5 Discussion

Pregnancy is a period during which many aspects of a woman's life change. With regard to stress, the descriptives of the present study showed that early pregnancy is the period in which most women reported most daily hassles and life events. In the course of pregnancy, these stress-provoking factors were found to decrease with almost 50%, whereas the psychological distress did not change with time. Therefore, it was of interest to test multidimensional models of distress three times in pregnancy to gain more insight into the similar and different predictors of distress throughout pregnancy.

The first aim of the study was to formulate and test a multidimensional model of prenatal stress cross-sectionally in early, mid-, and late pregnancy. In each period of pregnancy we found a significant multidimensional model of distress which explained most of the variance in the dependent construct (86%, 88% and 94%, respectively).

Two common predictors of distress were found throughout pregnancy. The general stress-provoking factor life events accounted for a significant part of the variance of distress in early, mid- and late pregnancy. In addition, neuroticism had a strong main effect on distress in each period of pregnancy. The main effect of life events on distress was somewhat unexpected, since other studies showed that life events had only a modest effect on health outcome (e.g. McEwen & Seeman, 1999; Rabkin & Struening, 1976). Instead, we had expected more effects of daily hassles on distress, according to other studies (DeLongis et al., 1982; Paarlberg et al., 1999). Neuroticism had a main effect rather than a moderating effect on the distress level, a finding in line with other studies (Ormel & Wohlfart, 1991; Cimbolich Gunthert et al., 1999). These authors argued that neuroticism is frequently associated with a chronic negative affectivity, which could explain the high scores on distress levels throughout preg-

nancy.

Daily hassles no longer accounted for increased distress in early and late pregnancy when personality factors and social support were included in our model. Only a small effect was found during mid-pregnancy. In contrast, we previously found that daily hassles have strong effects on distress, when personality factors and social support are not included (Huizink et al., 2000b). It has been suggested that negative emotionality, like anxiousness, is associated with an increased vulnerability to everyday problems and small irritations (Watson & Clark, 1984). Therefore, including neuroticism in the present models may have overruled the effect of daily hassles on distress. Another possibility is that distress and daily hassles are separable concepts, with different mechanisms underlying the possible effect on birth outcome and later development. After all, effects of both daily hassles (Paarlberg et al., 1999) and distress (Dunkel-Schetter, 1998) on birth outcome have been found. This possibility needs to be examined in future studies.

Other stress-provoking factors specifically related to pregnancy were found to result in increased levels of distress. In early pregnancy, the perceived uncontrollableness of the course of pregnancy resulted in more distress, whereas in mid-pregnancy the same resulted in increased pregnancy-related fears. The specific pregnancy-related anxieties also explained a significant part of the variance of distress in mid- and late pregnancy.

Emotion-focused coping appeared to buffer the stress response to the uplift of pregnancy in early pregnancy. Problem-focused coping had a direct inhibiting effect on distress in late pregnancy. If instrumental support was provided in the last part of pregnancy, more problem-focused coping was found. This finding corresponds well with our hypothesis that instrumental support would be welcomed during pregnancy. Especially in late pregnancy, when women are less mobile and preparations for the nursery are commonly carried out, instrumental support may be needed. Our findings suggest at least that when problems are encountered, instrumental support facilitates problem-focused coping. When social support is available in early and late pregnancy, the occurrence of daily hassles also increased coping. Thus, our findings support the view that social support must be considered a resource of coping strategies, rather than considering coping as an important determinant of social support. In early pregnancy, emotion-focused coping is activated, whereas in late pregnancy problem-focused coping is increased. Apparently, available social support buffered the effect of daily hassles on distress indirectly.

Another potentially moderating factor for the response to stress provoking factors was neuroticism (Fig. 7.1). In the present study, a strong direct effect was found for this personality aspect, rather than a moderating effect. Our sample consisted of normal risk pregnant women without very disturbing life conditions or great stressors. It may be that in situations of extreme stress provoking factors neuroticism would modify the stress response. Therefore, the models obtained in this study should be tested in high-risk pregnant women as well.

The second aim of the study was to analyze in a multidimensional model the differences in prenatal stress in early, mid- and late pregnancy. The results clearly showed that each period of pregnancy has some unique aspects that accounted for increased or decreased levels of distress. As previously reported, the most effective coping style changes from emotion-focused coping in early pregnancy to problem-focused coping in late pregnancy (Huizink et al., 2000b). In mid and late pregnancy, pregnancy-specific anxieties were found to increase distress, whereas in early pregnancy no such effect was found. In a previous study, we

showed that the highest levels of pregnancy-related anxieties were found in early pregnancy. Since these fears resulted in a measurable increase in distress only after several months of pregnancy had elapsed, perhaps the chronic effects of these fears may have resulted in more distress in the later stages of pregnancy.

The third aim of the study was to test for longitudinal effects of stress-provoking factors on distress. As described in the introduction, some stress provoking factors may have long-term effects on distress. Moreover, certain aspects of potential stressors could be confounded by distress. Therefore, we performed some longitudinal analyses. Simple correlation coefficients between distress scores in early, mid- and late pregnancy were found to be moderately high and statistically significant, suggesting that distress is a rather stable emotion throughout pregnancy. However, more detailed analyses showed that the factors contributing to the total amount of explained variance of distress differed in each period of pregnancy. This becomes clear from visual inspection of Figures 7.2 through 7.4. Statistically, it was found that the cross-sectional predictors of distress resulted in the best models of distress. Nevertheless, some similarities were found among the models of distress in early, mid- and late pregnancy. Neuroticism was a strong predictor of distress in each period of pregnancy. Since neuroticism reflects a relatively stable personality characteristic, this may explain the strong relationship between the levels of distress over time. On top of neuroticism, different factors accounted for the remaining variance of distress in early, mid-, and late pregnancy. These factors appeared to be rather specific for a particular period of pregnancy. This finding is supported by results of exploratory analyses in which we tried to fit the model of distress in early pregnancy with the data from mid- and late pregnancy. Similarly, the models of distress in mid- and late pregnancy were fitted with data from the other pregnancy periods. All resulting models had poor fits (results not shown), suggesting that they contain specific elements which contribute to distress. Life events had the strongest effect at the moment they were encountered in pregnancy, although a long term effect, three months later, was also found. However, current life events overruled the long-term effect of life events occurring in an earlier period of pregnancy. It is likely that the repeated occurrence of life events throughout pregnancy results in accumulating effects on distress. This calls for another type of analysis of these data in the future.

Pregnancy is a unique event in a woman's life, involving many adaptational changes but also naturally occurring biological changes in the body. In the present study, we have tested models of stress in this changing biological system and have found temporal changes in distress. However, our analyses have focused on the psychological level of distress. The biological system of pregnant women is unstable due to changes in hormone levels associated with pregnancy and offers a unique situation to test the effect of stress during a relatively short period of time. Perhaps the biological changes could have attributed to the differences found in the models of distress throughout pregnancy. In a next study we will examine the relationship between biological changes as reflected by levels of cortisol, β -endorphine, and ACTH, and the models of stress.

Our findings clearly show that a single measurement of distress in pregnancy is not sufficient to accurately describe prenatal stress. The multidimensional models of prenatal stress offer more insight into the processes that lead to increased distress levels in pregnant women. Prevention and intervention programs should take notice of the temporal specificity of certain aspects of the models. Although neuroticism is a stable and strong predictor of dis-

stress, other aspects related to emotions and cognition regarding pregnancy hold potential for modification. Since there is growing evidence that women with high prenatal distress are at increased risk for poor pregnancy outcome, prevention of high levels of distress is needed. The general models of prenatal distress described in the present study should be tested in specific high risk groups in the future, to identify the major distress causing factors. Then, specific prevention or intervention programs can be developed, which may have more potential to reduce the levels of distress and subsequently poor birth outcome. The temporal specificity of the models suggests that prevention and intervention programs of distress must take into account the period of pregnancy. It is recommended to take at least the following predictors of distress into account when testing the effect of prenatal stress on birth outcome or postnatal development: life events, neuroticism, secondary appraisal of pregnancy (early and mid-pregnancy), fear of bearing a handicapped child (mid- and late pregnancy), emotion-focused coping in early pregnancy and problem-focused coping in late pregnancy (Fig. 7.2-7.4).

In future studies we will examine if the concept of prenatal stress as described in the present study predicts birth outcome and later postnatal development. Our findings of this study suggest to take the amount of daily hassles into account as an independent predictor of birth outcome and development as well.

7.6 References

- Baron, R.M., and Kenny, D.A. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51, 1173-1182.
- Billings, A.G., and Moos, R.H. (1981). The role of coping responses and social resources in attenuating the stress of life events. *J Behav Med*, 4, 139-157.
- Bruder-Mattson, S.F., and Hovanitz, C.A. (1990). Coping and attributional styles as predictors of depression. *J Clin Psychol*, 46, 557-565.
- Burks, N., and Martin, B. (1985). Everyday problems and life change events: ongoing versus acute sources of stress. *Journal of Human Stress*, spring, 27-35.
- Byrne, B.M. (1998). *Structural equation modeling with LISREL, PRELIS, and SIMPLIS: basic concepts, applications, and programming*. Mahwah, New Jersey: Lawrence Erlbaum Associates, Publishers.
- Caplan, G. (1974). *Support systems and community mental health*. New York, NY: Human Sciences Press.
- Cimolic Gunthert, K., Cohen, L.H. and Armeli, S. (1999). The role of neuroticism in daily stress and coping. *Journal of Personality and Social Psychology*, 77, 1087-1100.
- Cobb, S. (1976). Social support as a moderator of life stress. *Psychosomatic Medicine*, 38, 300-314.
- Cohen, S., and Williamson, G.M. (1987). Perceived stress in a probability sample of the United States. In S. Spacapan and S. Oskamp (Eds.), *The social psychology of health*. (pp. 31-47). Newbury Park, California: SAGE Publications.
- Copper, R.L., Goldenberg, R.L., Das, A., Elder, N., Swain, M., Norman, G., Ramsey, R., Cotroneo, P., Collins, B.A., Johnson, F., Jones, P., and Meier, A.M. (1996). The preterm prediction study: maternal stress is associated with spontaneous preterm birth at less than thirty-five weeks' gestation. *American Journal of Obstetrics and Gynecology*, 175, 1286-1292.
- Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16, 297-334.
- Cutrona, C.E. and Russell, D.W. (1987). The provisions of social relationships and adaptation to stress. *Advances in Personal Relationships*, 1, 37-67.
- DeLongis, A., Coyne, J.C., Dakof, G., Folkman, S., and Lazarus, R.S. (1982). Relationship of daily hassles, uplifts, and major life events to health status. *Health Psychology*, 1, 119-136.
- Dohrenwend, B.S., Dohrenwend, B.P., Dodson, M., and Shrout, P.E. (1984). Symptoms, hassles, social supports, and life events: problem of confounded measures. *Journal of Abnormal Psychology*, 93, 222-230.
- Dunkel-Schetter, C. (1998). Maternal stress and preterm delivery. *Prenatal and Neonatal Medicine*, 3, 39 - 42.
- Elbourne, D., Oakley, A., and Chalmers, I. (1996). Social and psychological support during pregnancy. In Cholmers (Ed.), *Effective care in pregnancy and childbirth*.
- Endler, N.S., and Parker, J.D.A. (1993). The multidimensional assessment of coping: concepts, issues, and measurement. In: Van Heck, G.L., Bonaiuto, P. (eds). *Personality psychology in Europe*, volume 4: pp. 309-319. Tilburg, The Netherlands: University Press.
- Goldberg, D.P. (1972). *The detection of psychiatric illness by questionnaire*. London, Oxford University Press.
- Heitzmann, C.A., and Kaplan, R.M. (1988). Assessment of methods for measuring social support. *Health Psychology*, 7, 75-109.
- Herbert, T.B. and Cohen, S. (1993). Stress and immunity in humans: a meta-analytic review. *Psychological Medicine*, 55, 364-379.
- Holmes, T.H. and Rahe, R.H. (1967). The social readjustment rating scale. *Journal of Psychosomatic Research*, 11, 213-218.
- House, J.S. (1981). *Work, stress and social support*. Reading, Mass.: Addison Wesley.
- Huizink, A.C., Robles de Medina, P.G., Mulder, E.J.H., Visser, G.H.A. and Buitelaar, J.K. (2000a). Is pregnancy anxiety a relatively distinctive syndrome? Submitted.
- Huizink, A.C., Robles de Medina, P.G., Mulder, E.J.H., Visser, G.H.A. and Buitelaar, J.K. (2000b). Coping in normal risk pregnancy. Submitted.
- Huizink, A.C., Robles de Medina, P.G., Mulder, E.J.H., Visser, G.H.A. and Buitelaar, J.K. (2000c). Does coping mediate the effects of stress in pregnancy? Submitted.
- Jöreskog, K.G. and Sörbom, D. (1993). *LISREL 8: Structural equation modeling with the SIMPLIS command language*. Chicago, IL: Scientific Software International.
- Kanner, A.D., Coyne, J.C., Schaefer, C. and Lazarus, R.S. (1981). Comparison of two modes of stress measurement: daily hassles and uplifts versus major life events. *Journal of Behavioral Medicine*, 4, 1-39.
- Kaplan, B.H., Cassel, J.C. and Gore, S. (1977). Social support and health. *Medical Care*, 15, 47-58.

- Koeter, M.W.J. and Ormel, J. (1991). General Health Questionnaire. Nederlandse bewerking. Swets test services.
- Komproe, I.H., Rijken, M., Ros, W.J.G., Winnubst, J.A.M. and 't Hart, H. (1997). Available support and received support: different effects under stressful circumstances? *Journal of Social and Personal Relationships*, 14, 59-77.
- Komproe, I.H., Rijken, P.M., and Hoeks, I.A.M.L. (1991). Psychometrische eigenschappen van de vragenlijst 'Sociale steun en welbevinden' [Psychometric properties of the questionnaire 'Social support and Well-being']. Utrecht, The Netherlands: Utrecht University (unpublished manuscript).
- Lazarus, R.S. and Folkman, S. (1984). *Stress, appraisal, and coping*. New York, NY: Springer Publishing Company, Inc.
- Lobel, M., and Dunkel-Schetter, C. (1990). Conceptualizing stress to study effects on health: environmental, perceptual, and emotional components. *Anxiety Research*, 3, 213-230.
- Lou, H.C., Hansen, D., Nordentoft, M., Pryds, O., Jensen, F., Nim, J., and Hemmingsen, R. (1994). Prenatal stressors of human life affect fetal brain development. *Developmental Medicine and Child Neurology*, 36, 826-832.
- McEwen, B.S. and Seeman, T. (1999). Protective and damaging effects of mediators of stress. Elaborating and testing the concepts of allostasis and allostatic load. *Ann N Y Acad Sci*, 896, 30-47.
- Newton, R.W. and Hunt, L.P. (1984). Psychosocial stress in pregnancy and its relation to low birth weight. *British Medical Journal*, 288, 1191-1194.
- Nuckolls, K.B., Cassel, J. and Kaplan, B.H. (1972). Psychosocial assets, life crisis, and the prognosis of pregnancy. *American Journal of Epidemiology*, 95, 431-441.
- Ormel, J. and Wohlfarth, T. (1991). How neuroticism, long-term difficulties, and life situation change influence psychological distress: a longitudinal model. *Journal of Personality and Social Psychology*, 60, 744-755.
- Paarlberg, K.M., Vingerhoets, A.J.J.M., Passchier, J., Dekker, G., Heinen, A.G. and Geijn van, H. (1999). Psychosocial predictors of low birthweight: a prospective study. *British Journal of Obstetrics and Gynaecology*, 106, 834-840.
- Pillow, D.R., Zautra, A.J., and Sandler, I. (1996). Major life events and minor stressors: Identifying mediational links in the stress process. *Journal of Personality and Social Psychology*, 70, 381-394.
- Rabkin, J. and Struening, E. (1976). Events, stress and illness. *Science*, 194, 1013-1020.
- Rajab, K.E., Mohammed, A.M. and Mustafa, F. (2000). Incidence of spontaneous abortion in Bahrain before and after the Gulf War of 1991. *International Journal of Gynaecology and Obstetrics*, 68, 139-144.
- Russell, D.W. and Cutrona, C.E. (1984). The provisions of social relationships and adaptations to stress. Paper presented at the annual meeting of the American Psychological Association, Anaheim, CA.
- Schneider, M.L. (1992). The effect of mild stress during pregnancy on birth weight and neuromotor maturation in rhesus monkey infants (*Macaca mulatta*). *Infant Behavior and Development* 15, 389-403.
- Schneider, M.L. and Coe, C.L. (1993). Repeated social stress during pregnancy impairs neuromotor development of the primate infant. *Journal of Development and Behavioral Pediatrics* 14, 81-87.
- Schreurs, P.J.G., Willige, G. van de and Tellegen, B. (1988). *De Utrechtse Copinglijst (UCL): Een handleiding*. Lisse, The Netherlands: Swets en Zeitlinger.
- Selten, J.P., van der Graaf, Y., van Duursen, R., Gispens-de Wied, C.C. and Kahn, R.S. (1999). Psychotic illness after prenatal exposure to the 1953 Dutch Flood Disaster. *Schizophrenia Research*, 35, 243-245.
- Sheehan, T.J. (1998). Stress and low birth weight: a structural modeling approach using real life stressors. *Soc Sci Med*, 47, 1503-1512.
- Sheehan, T.J. (1996). Creating a psychosocial measurement model from stressful life events. *Soc Sci Med*, 43, 265-271.
- Shumaker, S.A. and Brownell, A. (1984). Toward a theory of social support: closing conceptual gaps. *Journal of Social Issues*, 40, 11-36.
- Sonderen, E. van (1991). *Het meten van sociale steun [Measuring social support]*. Groningen, The Netherlands: Universiteitsdrukkerij Groningen.
- Sonderen, E. van (1993). *Het meten van sociale steun met de Sociale Steun Lijst-Interacties (SSL-I) en Sociale Steun Lijst-Discrepanties (SSL-D). Een handleiding [Measuring social support by means of the Social Support List-Interactions (SSL-I) and Social Support List-Discrepancies (SSL-D). A manual]*. Groningen, The Netherlands: Noordelijk Centrum voor Gezondheidsvraagstukken.
- Spielberger, C.D., Gorsuch, I. and Lushene, R.E. (1970). *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA, Consulting Psychologists Press.
- Stone, A.A. and Neale, I.M. (1982). Development of a methodology for assessing daily experiences. In: A. Blaum and E.F. Singer (eds.). *Advances in Environmental Psychology*. Vol.4. Environment and health. Hillsdale, NJ: Erlbaum.
- Thoits, P.A. (1982). Conceptual, methodological, and theoretical problems in studying social support as a buffer against life stress. *Journal of Health and Social Behavior*, 23, 145-159.
- Van den Bergh, B. (1990). The influence of maternal emotions during pregnancy on fetal and neonatal behavior. *Pre- and Peri-Natal Psychology Journal*, 5, 119-130.

- Vingerhoets, A.J.J.M., Jeninga, A.J., and Menges, L.J. (1989).** Het meten van chronische en alledaagse stressoren: Eerste onderzoekservaringen met de Alledaagse Problemen Lijst (APL) II. *Gedrag en Gezondheid*, 17, 10-17.
- Wadhwa, P.D., Sandman, C.A., Porto, M., Dunkel-Schetter, C., and Garite, T.J. (1993).** The association between prenatal stress and infant birth weight and gestational age at birth: a prospective investigation. *American Journal of Obstetrics and Gynecology*, 169, 858-865.
- Watson, D. and Clark, L.A. (1984).** Negative affectivity: the disposition to experience aversive emotional states. *Psychological Bulletin*, 96, 465-490.
- Wilde, G.J.S. (1963).** *Neurotische labiliteit, gemeten volgens de vragenlijstmethode.* Amsterdam: Van Rossen, 1963.
- Willige van de, G., Schreurs, P., Tellegen, B., and Zwart, F. (1985).** Het meten van 'life events': de Vragenlijst Recent Meegemaakte Gebeurtenissen (VRMG). *Nederlands Tijdschrift voor de Psychologie*, 40, 1-19.