Negative effects and possible mechanisms of antenatal depression, anxiety and self-esteem on neonatal outcomes

PhD Thesis

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1. Introduction

Depressive and anxiety disorders are the most common psychiatric illnesses occurring during pregnancy. According to international data from market economic countries the prevalence of antenatal depression is 2.8-17%, while the prevalence of antenatal anxiety is approx. 10%. There are no relevant data among Hungarian women in pregnancy, however, in the survey *Hungarostudy 2002* 30.7% of adult women (>18 yr.) showed symptoms of mild, moderate or severe depression. 5.8% of them had moderate, a further 7.6% had severe depressive disorders. In another Hungarian study the life-time prevalence of anxiety in adult Hungarian women (18-60 yr.) was 22%, with a point-prevalence of 8%. In the same study life-time prevalence of affective-anxiety disorders was 17%, with a point-prevalence of 4%.

The onset and increase in prevalence of antenatal depression and anxiety could be explained by two different mechanisms: alterations in hormonal and vegetative status and changes in psycho-social status of pregnant women. Pregnancy brings on new challenges, higher expectation and a need for responsibility. Decreased working abilities due to somatic alterations, changes in social status and social network may lead to further complications. Economic problems, poverty, lack of social and emotional support may further increase the danger of the onset of depression or anxiety in pregnant women.

There are numerous international data showing that major depression during pregnancy increases the risk of pregnancy and birth complications (particularly premature birth and low birth-weight). Similar effects of antenatal anxiety have also been demonstrated on premature birth, on the 1 and 5 minutes decreased Apgar-score, or on the increase of arterial uterine resistance. Pregnant women with symptoms of depression or anxiety reported somatic problems and they consulted their physicians more often. However, there are also studies on antenatal depression and anxiety demonstrating no significant impact on birth outcomes.

Disturbances due to anxiety and depression usually combine with low self-esteem. Lower level of self-esteem seems to reduce the faith in accessibility of healthcare services, and restrict self-efficacy and openness towards health-improving interventions. Negative neonatal effects of maternal anxiety depression as well as lower level of self-esteem acts in two ways: by hormonal and vegetative changes (direct

effects), and through negative tendencies of lifestyle, such as alcohol consumption, smoking, substance abuse and medication non-compliance (indirect effects). However, there is a common motive in both mechanisms and this is the increase of the level of chronic stress as well as the narrowing of the adaptive behaviour. Figure1 shows the mechanisms mentioned above.

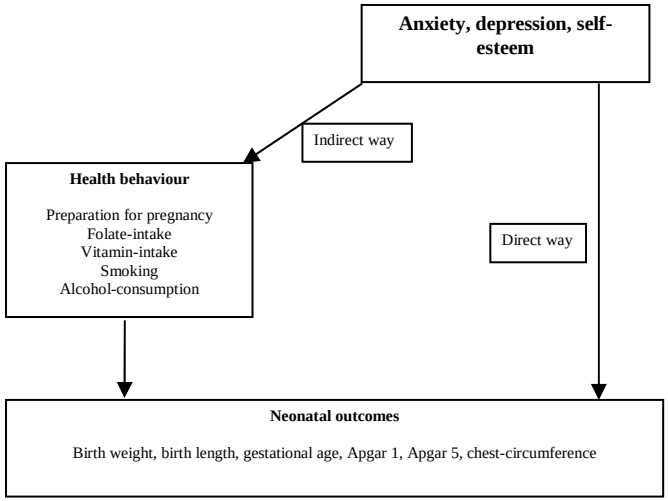

Fig.1.Possible associations between anxiety, depression, self-esteem and neonatal outcomes of pregnancies

Antenatal depression is more common in developing countries and in lower socio-economic and cultural strata of countries with market economy. Associations between demographic factors (age, educational, marital and socio-economic status) and depression and anxiety seem to be proven. Associations between demographic factors and elements of health behaviour are also proven: smoking, alcohol-consumption is more frequent among people with lower education and income. The question is whether the connection between unfavourable tendencies of health behaviour and depression, anxiety as well as lower self-esteem exists or it is only the result of effects demographic confounders. (Fig.2)

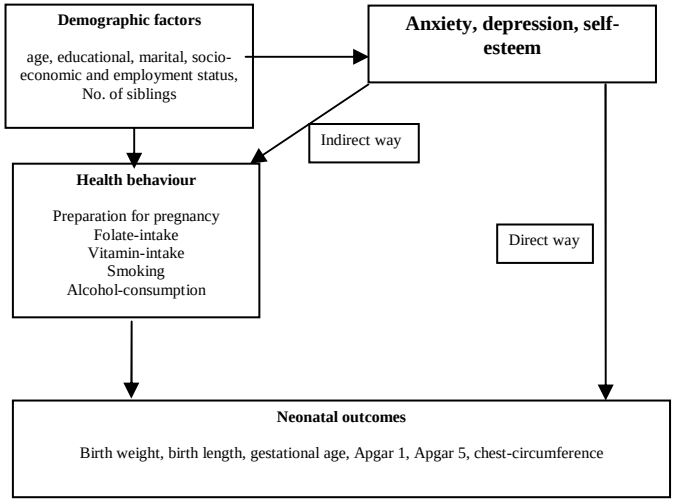

Fig.2: Possible effects of demographic factors

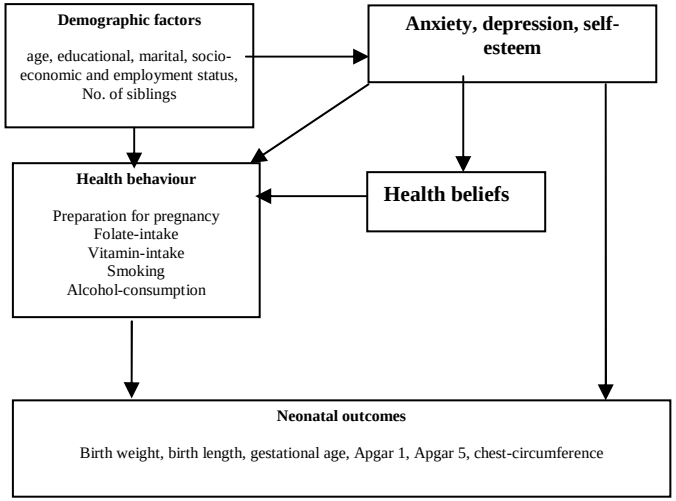

Fig.3: Possible associations of health beliefs with our former variables

Another question is, if it is so, how depression, anxiety and low level of self-esteem lead to unfavourable tendencies of health behaviour. One possible explanation is that smoking and alcohol-consumption appear in an automatic way as a self-medication or a stress-coping strategy to relieve affective symptoms of negative feelings. The other explanation may be that cognitive beliefs and dysfunctional attitudes which are very common in depressive – anxiety disorders may cause a deeper impact on one's health belief systems, decreasing the faith in the controllability of health, and these changes in health beliefs lead to unfavourable health behavioural tendencies. (Fig.3)

The effectiveness of health bettering interventions mainly depends on the participation and compliance of the target population. However, compliance and contribution are given only when interventions offered by public health promotion programs meet expectations of those concerned. Health beliefs deeply influence one's faith in the controllability of health and the openness towards health improving interventions. At the moment no data can be found on the effects of depression, anxiety, self-esteem and demographic factors on the openness towards health improving interventions.

Figure 4 shows the final model of our study with all the factors mentioned above.

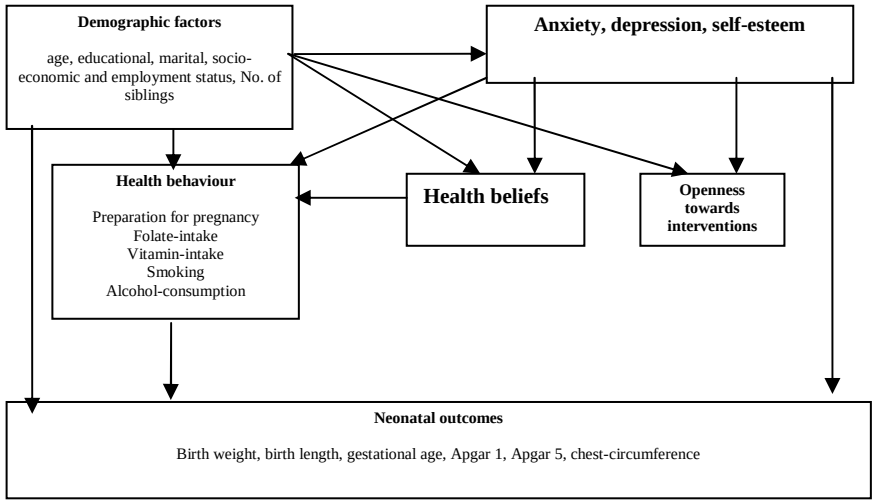

Fig.4 The final model of our study

2. The aims of the study

Findings of numerous international studies are controversial on the effects of antenatal depression and anxiety on the neonatal outcomes. If it is so, we still do not know the mechanisms of these negative effects: in a direct way through hormonal – vegetative alterations or in an indirect way through unfavourable health behaviour, or both. Connections between depressive-anxiety disorders and unhealthy behavioural tendencies are already well known, however it is unclear whether mental disorders act via alterations in health beliefs or act in a more direct way; or the given associations are pure artefacts of demographic confounders. There are no data on the effects of antenatal depression, anxiety on the openness toward health bettering interventions, either.

Based on the facts listed above the following aims were outlined:

1. To assess prevalence data of antenatal depression and anxiety and to reveal their associations with demographic covariates, by the establishment of a Hungarian population based sample.
2. To assess the effects of mental disorders (depression, anxiety, low level of self-esteem), demographic factors and health beliefs on the health behaviour of pregnant women.
3. To reveal the effects of mental disorders listed above and demographic covariates on the health behaviour and openness of pregnant women towards interventions.
4. To reveal connections between health beliefs and openness towards interventions.
5. Finally, to assess the effects of maternal antenatal depression, anxiety, low level of self-esteem, health behaviour and demographic factors on neonatal outcomes.

3. Population

Our population-based survey was carried out in Szombathely, a municipal town with 80100 inhabitants. There is a network of 18 nurse districts in the city where each nurse is responsible for the registration and health care of pregnant women living in her district. A population monitoring system was formulated from the 10 nurse districts of the 18 districts where data collection was continuous between 01.02.2008 and 01.02.2009.

The registration of the pregnancy happened on the gynaecologist's diagnosis. The pregnancies were diagnosed at the 8.22 gestational week on average (SD = 4.5 week). Data collection happened on the first meeting at the district nurse's office, at the time of the registration for prenatal care. Women had been interviewed, and the trained public health nurse filled in the standard questionnaire according to answers of the pregnant women. The informed consents were signed at the same time. The study protocol has been approved by the Regional Research Ethics Committee of the Medical Centre of the Pecs University (15-3460/2007). Participation was voluntary and anonymous. During the study period, 324 pregnancies were registered: 17 of them refused to participate; therefore 307 (94.8%) participants made up our study base. Those with medical treatment for severe psychiatric diagnoses or those who were unable to interpret our questionnaire (due to the lack of Hungarian language or extremely restricted cognitive ability) were excluded from the study. 17 out of the remaining 324 women refused to participate; therefore our primary database consisted of 307 participants (94.7% of those approached). By the end of our follow-up period 17 mothers were lost due to moving and 6 were excluded due to multiple pregnancies, in 23 further cases pregnancy ended in stillbirth or spontaneous abortion, therefore data from 261 mothers and their 261 neonates made up pour secondary database. This secondary database was used to analyse possible effects of anxiety, depression, self-esteem, health-behaviour and demographic variables on neonatal outcomes. All the others of our analyses was based on our primary database of 307 participants

4. Methods

Depressive symptoms were measured by the shortened, 9-item version of Beck Depression Inventory adapted to Hungarian conditions (Short Hungarian Version of the Beck Depression Inventory). Scores on this shortened scale have been converted to scores of the original inventory. Anxiety was assessed by trait-anxiety block (STAI-T) of the Hungarian version of the Spielberger State-Trait Anxiety Inventory form Y. Self-esteem was evaluated by the Rosenberg's Self-Esteem Scale.

Demographic data

The following demographic variables were registered in the survey: age, number of siblings, marital, educational, employment and socioeconomic status. Socioeconomic status was measured by the Family Income Assessment Scale, consisting of four questions on car-, computer-, private room-ownership and frequency of family holidays.

Components of health-behaviour

In our questionnaire three questions referred to preconception folic acid intake: 'Do you take prenatal vitamins?', 'Do you take any multivitamin products?' and 'Do you take folic acid pills?' Those giving negative answer to all three questions we regarded as not receiving folic acid supplementation. Those answering affirmatively to the first two questions were analysed further whether the pills contained the amount of folic acid recommended in pregnancy (0.4 mg/day). Those who met this requirement along with those answering affirmatively to the third question were regarded as folate supplementation receivers.

Responses ('yes, regularly; not regularly; not at all') referring to smoking-habits, alcohol-consumption and vitamin intake in the periconception period had been dichotomized (yes or no) in the following way: since smoking and drinking in the periconcepcion period are harmful even in small extent, only those answering not at all had been considered to be non-smokers and non-drinkers. On the contrary, in case of vitamin intake only answer 'yes, regularly' was accepted as positive answer since positive effect of irregular vitamin intake is rather questionable. In the end, we asked our participants whether they had been prepared for their pregnancy ('yes' or 'no')

Health beliefs

Heath beliefs were assessed by the second block of the questionnaire of Staiton-Rogers on health-and-illness beliefs (Health and Illness Scale). Statements were about lay explanations on reaching a better state of health in the future. The original 31 items in their original order were translated into Hungarian; the original scoring system was kept as well: our respondents gave scores of 1 to 7 depending on how much they agreed on that statement. To reveal the inner structure of health belief systems items were stepped into Factor Analysis, new factors of health beliefs created in this way were saved as new variables for further analysis.

Openness towards interventions

Openness towards interventions was assessed this way: websites most often visited by pregnant women were analysed to outline problems, difficulties, dilemmas of pregnant women. Then based on these findings seven possible interventions were established in order to be chosen by our participants depending whether the intervention offered could have helped her or not (1= it would not help me at all; 5= I need it very much) Interventions offered by us were the following ones: 'improvement of my health care'; 'transporting knowledge'; 'emotional support'; 'practical skills'; 'meeting pregnant women like me'; talking about my mental problems; 'food-fortification by vitamins'.

Obstetric history

The number of pregnancies, spontaneous and artificial abortions was also recorded.

Neonatal outcomes

Neonatal outcomes such as gender, birth-weight, birth-length, gestational age, 1 and 5 minute Apgar-scores and chest circumference were measured and assessed immediately after birth. Since head-circumference can be easily affected by compression of cranial bones through vaginal delivery, it was not included in our outcome variables.

Statistical methods

Statistical computation was performed by SPSS (Statistical Package for Social Sciences) 11.5 for Windows software with a level of significance $p<0,05$. Prevalence of depression and anxiety were assessed with 95%Confidential Interval, while associations

between depression, anxiety and demographic factors were tested by One-Way-ANOVA (Scheffé post hoc test).

Relations between elements of health behaviour (preparation for pregnancy, folate and vitamin intake, smoking, alcohol consumption) were tested by χ^2– test, while associations between demographic factors and elements of health behaviour were tested by mutivariate binary logistic regression. For potential covariance demographic variables were entered into our models by Forward Conditional method. Relations between depression, anxiety, self-esteem and health behaviour were also tested by mutivariate binary logistic regression (odd ratio /OR/, 95%CI).

Relations between health beliefs and health behaviour were assessed in two steps. At first, items of the Health and Illness Scale were evaluated with factor analysis: the number of factors with Eigenvalue higher than 1 were established by Principal Component Analysis, with the exclusion of factors with low explanatory power (<5%). The items with low communalities were also omitted stepwise. Factor analysis with Varimax rotation and Maximum Likelihood Estimation (MLE) was carried out for the remaining items. Factor, loading of an item higher than 0.4, was taken as the condition of pertaining to a factor. Items unable to meet this requirement were excluded stepwise. Finally, factors created in the above mentioned way were saved as new variables in a standardized form. Associations between these new continuous variables and elements of health behaviour were also tested by multivariate binary logistic regression.

Multivariate linear regression was applied to establish correlations between depression, anxiety, self-esteem, health beliefs and openness towards interventions, and to reveal associations of health beliefs with openness towards interventions. Categorical variables (educational, marital and employment status) were used as 'dummy' variables. In the end, associations among depression, anxiety, self-esteem, as well as health behaviour and neonatal outcomes were also tested by multiple linear regression analysis in girls and boys separately. For the possible covariance, our explanatory variables were entered into our models by Forward method. Categorical variables were also used as "dummy variables". Gender differences of the means of neonatal parameters were tested by Independent-Samples t-test.

5. Results

5.1. Associations between antenatal depression, anxiety and demographic factors

In our sample 17.9% of pregnant women showed depressive symptoms. 1.0% of them had major depression. Prevalence of anxiety was 14.6%. 4.2% of our participants had clinically significant anxiety. Women with education less then vocational level showed more symptoms of anxiety (STAI-T mean=42.75) than those with secondary education (39.06; One-Way-ANOVA $p<0.05$) or higher/university (38.02; $p<0.01$), and showed higher level of depression (BDI mean=8.54) than those with secondary education (5.42; $p<0.05$). Women of the lowest level of socio-economic status showed higher level of depression (10.45), than those of lower-middle (5.15; $p<0.001$). and of upper-middle level. (6.08; $p<0.01$) In the same way, anxiety level in the lowest level of socio-economic status was higher (44.45) than in the lower-middle (39.74; $p<0.05$) or in the upper middle stratum (37.40; $p<0.001$). Unemployed women had higher level of depression (8.35 vs. 5.55; $p<0.01$) and anxiety, as well (43.00 vs. 38.55; $p<0.001$). Minors (<18 yr.) showed higher level of depression (12.43) than women between 18-35 yr. (5.97; $p<0.05$) and those above 35yr. (5.03; $p<0.05$). Participants living in common law marriage showed higher level of depression than married women (7.15 vs. 5.19; $p<0.05$).

5.2. Associations between demographic factors and health behaviour

Those who prepared for their pregnancy were significantly older (30.28 vs. 27.65. One-Way-ANOVA $p<0.001$), and they had higher socioeconomic status (4.19 vs. 3.50 $p<0.01$) than those who did not prepare. The higher the educational level was the higher the prevalence of preparation was, too (chi-square test: $p<0.001$). Employed women prepared for pregnancy more often ($p<0.001$). Prevalence of preparation for pregnancy was the lowest among single/divorced women, while the highest rate was found among married women ($p<0.01$). Younger age, lower socio-economic status, more siblings and less than secondary educational level decreased the chance of folate intake (OR=0.36; 95%CI=0.18-0.72). Vitamin intake was also less frequent among young women, those with lower than secondary educational level (OR=0.35; 95%CI=0.16-0.78), and among those living in common law marriage (OR=0.46; 95%CI=0.25-0.87).

The chance of smoking was higher in women with lower than secondary education (compared to higher/university level) (OR=4.72; 95%CI=2.34-9.51), and among those living in common law marriage compared to married participants (OR=2.74; 95%CI=1.54-4.89).

5.3. Associations between depression, anxiety, self-esteem and elements of health-behaviour.

Higher levels of trait-anxiety corresponded with less preparation for pregnancy (OR = 0.955; 95%CI = 0.923-0.988) and vitamin-intake significantly (OR = 0.954; 95%CI = 0.922-0.987). Those with higher levels of self-esteem tended to consume less alcohol (OR = 0.943; 95%CI = 0.892-0.997). while higher level of depression was positively associated with smoking (OR = 1.106; 95%CI = 1.060-1.154). However, after having been controlled for confounding effects of demographic factors, only the role of depression remained significant on vitamin intake (EH=0.947; 95%MT=0.900-0.997) and on smoking (EH=1.104; 95%MT=1.053-1.158).

5.4. Associations between health beliefs and health behaviour

Three fourth of our participants (73.2%) prepared for their pregnancies and more than half of them took the opportunity of folate-supplementation (55.4%) but only 30.5% of them took vitamins regularly. Prevalence of non-smokers was 71.2%. while one third of our sample did not drink alcohol at all. Those who scored high on the health belief factor ‘mental capacities and abilities’ had greater chance on folate (EH=1.467; 95%MT=1.126-1.910) and vitamin intake (EH=1.444; 95%MT=1.046-1.992), as well as on preparation for pregnancy (EH=1.454; 95%MT=1.117-1.893), and had a less chance on smoking (EH=0.716; 95%MT=0.554-0.924). Higher scores on factor ’destiny’ (EH=0.772; 95%MT=0.597-0.997), ’professionals’ prevention’ (EH=0.710; 95%MT=0.535-0.943) and ’relatives and acquaintances’ (EH=0.732; 95%MT=0.552-0.970) correlated with less chance on folate intake. The factor ’professionals’ prevention’ was associated with less chance on vitamin intake, too (EH=0.652; 95%MT=0.480-0.885).

5.5. Associations between health beliefs and health behaviour

In all of our models on the associations of health beliefs with the openness towards interventions all health belief factors showed positive correlations. The factors ’environment’, ’destiny’ and ’external influences’ correlated with intervention marked *’improvement of my health care’*., while ’food-fortification’ was related to factors ’environment’ and ’external influences’ Factors ’environment’, ’destiny’ and ’relatives and acquaintances’ correlated with interventions *’emotional support’* and *’talking about mental problems’*; although in case of both interventions the role of one of the factors had borderline significance only. Beyond the factors above, there was a significant relation between *’emotional support’* and ’professionals’ prevention’. Interventions *‘transporting knowledge’;* and *‘practical skills’* were associated with the same factors, namely ’environment’; ’external influences’ and ’professionals’ prevention’ Intervention *‘meeting pregnant women like me’* correlated with ’relatives and acquaintances’ and ’environment’. Interventions offered by us requiring less individual involvement were generally preferred by those who had the tendency to explain their state of health by external, hardly controllable contributing factors or by the decision of others.

5.6. Associations between depression, anxiety, self-esteem and health beliefs as well as openness towards interventions in pregnant women

Young pregnant women preferred interventions *‘meeting pregnant women like me’* (β= -0.198; p<0.01) and *‘practical skills’* (β= -0.23; p<0.001), while those living in common law marriage needed *’emotional support’* (β= 0.143; p<0.05). Those with higher level of anxiety said that *’talking about mental problems’* (β= 0.195; p<0.05), and *’food fortification’* (β= 0.195; p<0.05) would have helped them most. Mothers of higher age (β= 0.213; p<0.01) and of higher level of self-esteem (β= 0.194; p<0.01), and the single ones (β= 0.153; p<0.05) considered health belief factor ’mental capacities and abilities’ as most important for their health status, single pregnant women found ’relatives and acquaintances’ important, as well (β= 0.152; p<0.05). Maternal anxiety correlated positively (β= 0.247; p<0.01), while depression correlated negatively with greater openness towards ’professionals’ prevention’ (β= -0.152; p<0.05).

5.7. Associations of maternal antenatal depression, anxiety and health behaviour with neonatal outcomes

Parameters of the intrauterine growth tended to be higher in boys than in girls (birth weight: 3380 g vs. 3225 g; t-test: p<0.05; birth length: 50.5 cm vs. 49.8 cm; p<0.05; chest-circumference: 33.6 cm vs. 33.0 cm. p<0.01). There were no differences in gestational age or in 1 and 5 minute Apgar-scores. Antenatal depression, anxiety, also with elements of health behaviour did not predict any of the studied neonatal outcome measures. However, lower level of self-esteem significantly associated with intrauterine growth showing negative correlation with birth weight (β= 0.212; p<0.05) and birth length in boys (β= 0.191; p<0.05), and with birth length of girls (β= 0.174; p<0.05). Among demographic factors, low levels of education were associated with smaller birth-length (β= 0.298; p<0.01) and smaller chest circumference (β= 0.233; p<0.05), as well as with lower gestational age in boys (β= 0.235; p<0.01), and with smaller birth-length in girls (β= 0.239; p<0.01). In girls only, socio-economic status showed positive associations with birth-weight (β= 0.204; p<0.05) and gestational age (β= 0.210; p<0.05), while common law marriage had a negative effect on birth-weight (β= -0.174; p<0.05) and chest circumference (β=-0.219; p<0.05).

6. Theses

1. In our sample prevalence of antenatal depression and anxiety did not differ from those in market economic countries; however they happened to be less prevalent than in female adult population found by former Hungarian surveys.
2. Antenatal depression and anxiety had a moderate direct effect on health behaviour: connections between them were made through the transformation of health belief system and mainly by demographic confounders.
3. Health beliefs effected health behaviour and openness towards health bettering interventions. Those who found health belief factors representing Internal Locus of Control important showed favourable health behavioural tendencies in all way. In the same way, interventions offered by us which required less individual involvement were preferred by those who had the tendency to

explain their state of health by external, hardly controllable contributing factors or by the decision of others.

4. Maternal antenatal depression, anxiety and self-esteem along with demographic factors had moderate effects on health belief and interventional expectations explaining 7.8%-15.7% of the variance of health belief factors, and 7.8%-9.6% of the openness towards interventions. Younger participants needed to meet other pregnant women, and training on practical skills. Health beliefs and interventional preferences of those living alone or in common law marriage showed more need for closer human relations and for emotional and mental support. Maternal anxiety correlated positively, while depression correlated negatively with greater openness towards preventive methods. Mothers of higher age and self-esteem found health belief factor 'mental capacities and abilities' as most important for their health status.
5. Antenatal depression, anxiety, also with elements of health behaviour did not predict any of the studied neonatal outcome measures. However, lower level of self-esteem significantly associated with intrauterine growth showing negative correlation with birth-weight and birth-length in boys, and with birth-length in girls. Among demographic factors, low levels of education were associated with smaller birth-length and smaller chest circumference, as well as with lower gestational age in boys and with smaller birth-length in girls. In girls only, socio-economic status showed positive associations with birth-weight and gestational age, while common law marriage had a negative effect on birth-weight and chest circumference.
6. Since we did not find any association of health practices with neonatal outcomes our conclusion is that lower level of maternal self-esteem may act through hormonal – vegetative alterations due to maternal stress reducing foetal growth directly.
7. Our findings show a new direction to future studies, as well: gender differences in the influence of demographic factors on birth outcomes need further investigations to be able to understand differences of foetal development in boys and girls.