

# The Mediation Effect of Coping Strategies Between Personality and Blood Pressure in Pregnancy Complicated by Hypertension

**Sabrina Chapuis-de-Andrade**

PUCRS: Pontificia Universidade Catolica do Rio Grande do Sul

**Carmen Moret-Tatay** (✉ [carmenmorettatay@gmail.com](mailto:carmenmorettatay@gmail.com))

Universidad Catolica de Valencia San Vicente Martir <https://orcid.org/0000-0002-2867-9399>

**Tatiana Quarti Irigaray**

PUCRS: Pontificia Universidade Catolica do Rio Grande do Sul

**Ivan Carlos Ferreira Antonello**

PUCRS: Pontificia Universidade Catolica do Rio Grande do Sul

**Bartira Ercilia Pinheiro da Costa**

PUCRS: Pontificia Universidade Catolica do Rio Grande do Sul


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## Research

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## Abstract

**Background:** Hypertension is a disorder that affects many people and its complications can cause serious damage to health. In pregnancy, it is even more serious with risks both to pregnant women and their fetuses. This study investigated the role played by personality and coping strategies in blood pressure levels during pregnancy. Its specific goal was to study whether coping strategies can mediate the effect of personality in pregnancy complicated by hypertension.

**Methods:** Assessment of a sample of 351 pregnant women, encompassing 192 pregnancies complicated by hypertension. This is a cross-sectional study where personality traits were measured by the Five-Factor Model and coping was evaluated by the Jalowiec's Coping Inventory.

**Results:** Personality can partially predict systolic and diastolic blood pressure. Openness to experience trait and emotion focused coping correlated with systolic and diastolic blood pressure. Diastolic blood pressure was predicted by openness to experience ( $\beta = -.15$ ;  $p < .05$ ). Systolic blood pressure was also predicted by openness to experience ( $\beta = -.14$ ;  $p < .05$ ).

**Conclusions:** It is suggested to reinforce the development of coping strategies that are more focused on the problem than on emotion, in order to avoid negative effects of emotional coping in blood pressure in pregnancy.

## Background

Hypertension is one of the leading causes of medical complications during pregnancy. It occurs in 5 to 10% of all pregnancies, being the main factor of maternal and fetal mortality and morbidity worldwide (Coutinho, Lamai, & Nerenberg, 2018).

It should be noted that there are different classifications for hypertensive disorders in pregnancy. According to the National High Blood Pressure Education Program Working Group on High Blood Pressure in Pregnancy, they can be broken down into: gestational hypertension, preeclampsia/eclampsia, chronic hypertension and preeclampsia superimposed on chronic hypertension (Gifford, 2000). Gestational hypertension is characterized by high blood pressure (a systolic blood pressure greater than or equal to 140 mmHg or a diastolic blood pressure greater than or equal to 90 mmHg), normalized no later than the twelfth week after childbirth, without the presence of proteinuria. However, many women can progress to preeclampsia, which is determined by the combined presentation of high blood pressure, proteinuria, and maternal organ dysfunction. Characterized by the presence of generalized tonic-clonic seizures, eclampsia is the most serious condition in hypertensive disorders. Chronic hypertension is traditionally diagnosed by high blood pressure before the twentieth week of gestation and does not disappear after week twelve postpartum. Women who are chronically hypertensive and present proteinuria after the twentieth week of gestation are considered to have preeclampsia superimposed on chronic hypertension (Gifford, 2000).

Importantly, risk factors for hypertensive disorders in pregnancy may be of different etiologies. Nulliparity, maternal age, ethnicity and higher blood pressures during pregnancy, amongst other factors, can put women at a higher risk in pregnancy (Gifford, 2000). Even as most of these variables might be considered to be physical, several psychological variables should also be included. More precisely, personality might play a crucial role as it has been considered an important predictor of physical and mental health (Hengartner, Kawohl, Haker, Rössler, & Ajdacic-Gross, 2016; Mols & Denollet, 2010).

Personality may be understood as a comprehensive conceptualization, including behavior, motivation, cognition and emotion, which are unique for each person (McCrae & Costa, 2008). The assessment of personality can be available in different forms, such as explicit and implicit mental or associative representations and observable behavior biological functioning (McAdams & Pals, 2006). In this study we use the Five-Factor Model (Big Five), that focus on explicit, implicit, and behavioral manifestations, which can explain the relation to hypertensive disorders in pregnancy.

Regarding previous research into personality issues, authors found that people who achieve high scores on neuroticism and low on openness to experiences have worst cardiovascular response to stress reactions (Bibbey, Carroll, Roseboom, Phillips, & de Rooij, 2013). Additionally, during pregnancy neuroticism was associated with negative outcomes. Previous studies show that neuroticism was associated with the development of postpartum depression symptoms (Imširagić, Begić, Vuković, Šimićević, & Javorina 2014). However, openness personality trait can decrease the risk for postnatal depression symptomatology (Imširagić et al., 2014). Mothers' breastfeeding intentions were negatively associated with neuroticism as well (Di Mattei et al., 2016). Moreover, women who have more traits of neuroticism, openness to experience and scored lower on consciousness and agreeableness have a high risk for preterm labor (Handelzalts et al., 2016).

It is known that subjects who score higher on neuroticism tend to feel more negative emotions, such as feelings of nervousness, tension, insecurity and worry (McAdams & Pals, 2006). Consequently, these people usually have inefficient coping strategies. The development of coping strategies is crucial during pregnancy, due to all the transformations happening on both physical and psychological levels. It is known that coping strategies that women use to confront problems, can contribute both to improving their health as well as further aggravating pregnancy disorders. This is especially true if the women have a pregnancy complicated by hypertension, where they need to lead with many adversities.

Coping, is defined as a set of cognitive and behavioral strategies that subjects use to manage their stress (Folkman & Moskowitz, 2004). Of note, there are different strategies to deal with the same problem. However, coping can be classified into two main groups (Vitaliano, Maiuro, Russo, & Becker, 1987): problem-focused (confrontive and supportant coping styles that usually respond actively to stressful situations) and emotion-focused (evasive, fatalistic, optimistic, emotive, palliative and self-reliant that tend to deal more with feelings when they are in a stressful situation). The present study uses the Jalowiec's Coping Inventory in order to examine strategies for coping in pregnant women. This instrument consists of 60 items, with 8 styles of coping: confrontive (10 items), evasive (13), optimistic (9), fatalistic (4), emotive (5), palliative (7), supportant (5), self-reliant (7) (Vitaliano et al., 1987).

Additionally, previous studies already showed that coping might instead serve as a mediator of life quality (Joshani, 2018). A mediator is understood as a variable that may serve as an instrument through which one variable influences another (Baron & Kenny, 1986). Also, the mediation model recognizes that the subjects' coping strategies employed are linked to their stress levels, transferring the effects to other underlying variables. In this study we want to understand if a specific coping strategy (emotion or problem focused) will lead to higher levels of blood pressure, regardless of personality.

Searching for understanding human behavior is key to know how to approach health and disease issues in a singular and effective way. Although the literature is extensive on this topic, there are many questions that remain unclear concerning personality, coping and blood pressure in the particular case of pregnancy complicated by hypertension.

We hypothesized that some traits of personality can be associated with increased blood pressure during pregnancy. A recent study, for example, found that openness to experience was able to predict blood pressure, and this effect was larger for systolic pressure (Gallagher, O'Riordan, McMahon, & Creaven, 2018). Since personality can be considered unalterable (McCrae & Costa, 2008), other variables, such as coping strategies might mediate its effect. For this proposition the study puts forward a mediation model of coping, affecting the relationship of personality on blood pressure in pregnancy complicated by hypertension.

## Methods

### Participants

This cross-sectional study was conducted using an incidental sample made up of 351 pregnant women in the third trimester. Demographic and obstetric information were collected via medical records. Data included age, ethnicity, anthropometric data, level of education, employment and marital status, social support, parity and previous pregnancy outcomes. Clinical features, such as laboratory tests (i. e. urinary protein and creatinine measurements), history of anemia, hypertension or any other physical or psychological complication were extracted from the medical records.

### Instruments

In this study we used the Brazilian version of the following instruments (all of them were adapted and validated for the Brazilian Portuguese language):

#### • Mini Mental State Examination

This instrument measures global cognitive functioning, such as temporal evaluations, space, attention, calculations, memory, language and visual constructive capacity. Scores range between 0 (high cognitive impairment) and 30 points (better cognitive capacity). We included women achieving scores equal or superior to 27.

#### • The Five-Factor Model - Big Five

It consists of 44 self-report items constructed to allow quick and efficient assessment of the 5 personality dimensions. The participants used a five-point Likert scale: strongly disagree, somewhat disagree, neither agree nor disagree, somewhat agree, and strongly agree. Mean scores were computed across the items of every scale separately. In this sample, the coefficients of internal reliability (General Cronbach's  $\alpha = 0.84$ ) were: extraversion  $\alpha = .88$ , agreeableness  $\alpha = .75$ , conscientiousness  $\alpha = .88$ , neuroticism  $\alpha = .82$ , and openness to experience  $\alpha = .70$ .

#### • Jalowiec's Coping Inventory

This instrument evaluates generic coping with concise descriptions of specific cognitive and behavioural strategies. Women answered how much they used each coping strategy to deal with or handle the stressor. Self-report ratings for each item were made on a Likert scale from 0 (never used) to 3 (often used). Coping style of participants were calculated in the following way: items marked in each question are summed up and divided by the number of items contained in the subscale, called the middle score; the mean score of each subscale is calculated by dividing and summing up the total mean scores and the coping style was defined by the highest score (Jalowiec, 1985). For this study, the internal consistencies for each scale were computed: confrontive (.79), supportant (.63), evasive (.81), fatalistic (.74), optimistic (.62), emotive (.79), palliative (.58), self-reliant (.47) and the global Cronbach's alpha was .90. Cronbach's alpha of .77 was confirmed for problem-focused coping and an alpha of .87 for emotion-focused coping.

### Procedure

The survey was conducted from December 2016 to October 2018. Women filled out the questionnaires individually during their visit to a Hospital in the southern region of Brazil, a specialized center for high risk pregnant women care. Women were eligible if they were 18 years of age or older. Exclusion criteria included previous diagnosis of kidney disease, a history of diabetes, fetal malformation and/ or lack of information in the database. All women received a detailed explanation about the study. Written informed consent was obtained from all study participants. Completing the questionnaire took on average 40 minutes, approximately. The anonymity and confidentiality of data and voluntary participation were ensured, as well as all ethical standards were followed according to the National Research Council of Brazil (Resolution 466/2012) and the Code of Ethics of the World Association. The local Institutional Review Board approved the study (Protocol N°. 1.777.443-CEP).

### Data analysis

The statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) 22. We conducted a mediational analysis using Process macro for SPSS (Hayes, 2015) to test the hypothesis that coping mediates the effect of personality on blood pressure. In this way, Regression-based procedures were executed employing bootstrapping procedures using 10000 samples (MacKinnon & Fairchild, 2009; Moret-Tatay, Lami, Oliveira, &

Beneyto-Arrojo, 2018). Figure 1 depicts this analysis in terms of variables and paths. X is represented as the independent variable (personality), Y the dependent variable (blood pressure) and M the mediational variable (coping). Paths are represented by the letter a (the effect of X on M), b (the effect of M on Y) and c' (the effect of X on Y), and c depicts the total effect. Moreover, more than one mediator can be included, as illustrated in the Fig. 1.

We try to assess whether the independent variable influences the (non-observable) mediator variable, which in turn influences the dependent variable. Therefore, this evaluation will characterize the nature of the relationship between the independent and dependent variables (MacKinnon, 2008).

## Results

A total sample of 351 women participated in the study. According to prior hypertension in pregnancy diagnosis, women were classified as follows: i) gestational hypertension (16.8%), ii) preeclampsia syndrome (29.3%), iii) chronic hypertension (8.5%), iv) control group encompassing healthy women with uncomplicated pregnancies (45.3%). With regards to educational level, a 60.7% had basic studies, 33.6% intermediate and 5.7% superior ones. The proportion of Caucasian women in the control group was 24% and in the hypertensive group 22%. The mean gestational age in the control group was 271.76 (SD = 12.77) days and in the hypertensive group 264.75 (SD = 19.52) days. In total, 32% of control group was primiparous and 40% of women with pregnancy complicated by hypertension were primiparous. The proportion of women that work or study in the control and hypertensive groups were 76% and 82%, respectively. Regarding social support, 0.9% of control group and 1.3% of hypertensive women reported have no one to count on. Finally, more than 77.5% reported to be married or in a relationship. Other demographic data are depicted in Table 1.

Table 1  
Descriptive characteristics of study participants in terms of Mean and Standard deviation in parenthesis.

	n (%)	MA (years)	Height (cm)	Weight (kg)	SBP (mmHg)	DBP (mmHg)	GA (days)
Control	159 (45.3)	26.32 (5.70)	160.71 (6.24)	77.79 (13.60)	118.67 (13.29)	73.94 (11.84)	269.18 (21.90)
Hypertensive	192 (54.7)	28.60 (6.87)	161.68 (6.58)	88.41 (17.62)	146.47 (19.27)	90.20 (13.88)	257.12 (26.07)

*MA = Maternal age; SBP = Systolic blood pressure; DBP = Diastolic blood pressure; GA = Gestational age.*

Secondly, the relationship between variables under study was examined. Pearson coefficient was calculated among systolic and diastolic pressure, Big Five traits of personality and coping (problem and emotion focused). Note that openness to experience trait and emotion-focused coping correlated with both blood pressures.

Table 2  
Pearson coefficient under the variables under study

	Systolic	Diastolic	Openness to experience	Conscientiousness	Extroversion	Agreeableness	Neuroticism	Problem focused coping	Emotion focused coping
Systolic	1								
Diastolic	.778**	1							
Openness to experience	-.193**	-.168**	1						
Conscientiousness	-.075	-.039	.445**	1					
Extroversion	-.128*	-.118*	.644**	.193**	1				
Agreeableness	-.056	-.074	.357**	.344**	.210**	1			
Neuroticism	-.017	.013	-.193**	-.049	-.185**	-.524**	1		
Problem focused coping	.055	.088	.469**	.364**	.282**	.379**	-.265**	1	
Emotion focused coping	.272**	.227**	-.044	-.259**	-.009	-.154**	-.046	.412**	1

\*\*=p < .01; \*=p < .05

On the other hand, a regression analysis on the prediction of blood pressure was carried out. Variables such as group (control and hypertensive), Big Five traits of personality and coping (problem and emotion focused), were included as independent variables. Diastolic blood pressure was predicted by openness to experience ( $\beta = -.17$ ;  $p < .05$ ) and group ( $\beta = -.49$ ;  $p < .001$ ):  $F(11,339) = 13.35$ ;  $p < .001$ ;  $R^2 = .30$ . Systolic blood pressure was also predicted by openness to experience ( $\beta = -.15$ ;  $p < .05$ ), anxiety ( $\beta = -.21$ ;  $p < .001$ ), and group ( $\beta = -.60$ ;  $p < .001$ ):  $F(11,339) = 23.97$ ;  $p < .001$ ;  $R^2 = .42$ .

A mediational approach was carried out. The model was estimated in both strategies of coping simultaneously. In this way, the whole dataset was employed in order to have more data variability in the dependent variable blood pressure (in other words, the relationship between personality and blood

pressure disappeared by splitting the groups). As expected, prediction of diastolic and systolic pressure, though openness to experience, reached the statistical significance level with a similar explained variance ( $p < .001$ ;  $R^2 = .22$ ). A similar pattern occurred for agreeableness for both pressures ( $p < .001$ ;  $R^2 = .14$ ). Conscientiousness just predicted systolic pressure ( $p < .001$ ;  $R^2 = .13$ ). Figure 2 illustrates the simultaneous model and Table 3 depicts the confidence interval (CI) that at 95% was statistically significant with a confidence interval excluding the zero value.

Table 3  
Effects of X on Y for openness to experience in blood pressure, standard error (SE), statistical significance and lower and upper (LLCI and ULCI) levels.

Blood pressure	Effect Type	Effect	SE	LLCI	ULCI
Diastolic	Total	-.17	.04	-.26	-.07
	Direct	-.21	.05	-.32	-.10
	Total Indirect	.05	.03	-.016	.115
	a1b1 Indirect	.05	.03	-.0007	.117
	a2b2 Indirect	.04	.02	.015	.084
Systolic	Total	-.04	.05	-.176	.067
	Direct	.03	0.06	-1.01	.169
	Total Indirect	-.073	.041	-.158	.007
	a1b1 Indirect	-.009	.026	-.062	.041
	a2b2 Indirect	.052	.016	.025	.092

Table 4  
Effects of X on Y for conscientiousness in Blood pressure, Standard error (SE), statistical significance and lower and upper (LLCI and ULCI) levels.

Blood pressure	Effect Type	Effect	SE	LLCI	ULCI
Systolic	Total	-.07	.05	-.177	.026
	Direct	.04	0.06	-.08	.17
	Total Indirect	-.11	.042	-.20	-.03
	a1b1 Indirect	-.03	.022	-.084	.01
	a2b2 Indirect	-.08	.02	.002	.095

Table 5  
Effects of X on Y for Agreeableness in Blood pressure, Standard error (SE), statistical significance and lower and upper (LLCI and ULCI) levels.

Blood pressure	Effect Type	Effect	SE	LLCI	ULCI
Diastolic	Total	-.07	.05	-.18	.03
	Direct	-.04	.06	-.17	.04
	Total Indirect	-.02	.03	-.09	.04
	a1b1 Indirect	-.03	.01	-.06	-.009
	a2b2 Indirect	.03	.02	-.01	.08
Systolic	Total	-.05	.05	-.16	.04
	Direct	.02	.06	-.10	.14
	Total Indirect	-.07	.03	-.015	-.01
	a1b1 Indirect	-.03	.02	-.008	.01
	a2b2 Indirect	.04	.01	-.09	-.01

This model is based in the first model from the Fig. 1 which represents a simple statistical mediation model. In the current model, we aim to assess mediation with multiple mediators simultaneously, as coping is considered to be twofold in this model: emotional and problem focused (M2 and M1, respectively).

## Discussion

In this study we found that personality can partially predict systolic and diastolic blood pressure. Contrary to expectations, no effects were observed for neuroticism trait, as a mediator of associations between personality and blood pressure in pregnancy.

Neuroticism is known as a negative trait of personality. It is understood as a tendency to feel anxiety, guilt, sadness, anger and nervousness (McAdams & Pals, 2006). Also, it is associated with high reactivity, sensitivity to stress and emotional instability (Navrady, Adams, Chan, Ritchie, & McIntosh, 2018). People presenting more traits of neuroticism tend to have unrealistic ideas and usually face more difficulties in dealing with problems (McCrae & Costa, 2008). Authors show that high neuroticism at baseline were significantly associated with a higher risk of loneliness and isolation (Ormstad, Eilertsen, Heir & Sandvik, 2020). However, data that show neuroticism as predictive of diseases and changes in health status remain unclear. A prospective study found that higher neuroticism was strongly related to the risk of coronary heart disease (Jokela, Pulkki-Råback, Elovainio, & Kivimäki, 2014). Also, authors found that neuroticism can be predictive of raised blood pressure (Turiano et al., 2011). On the other hand, a large study that included data from 76,150 participants failed to find an association between neuroticism traits and mortality risk (Jokela et al., 2013).

Our data show that the openness to experience trait and emotion-focused coping correlated with systolic and diastolic blood pressure. Regarding personality, previous studies have also found similar results. Authors found that personality, especially openness, could moderate the association between life event stress and both types of blood pressures (Gallagher, O'Riordan, McMahan, & Creaven, 2018). Another study also found that openness was associated with both systolic and diastolic blood pressure responsivity (Ó Súilleabháin, Howard, & Hughes, 2018). People who achieve high scores in openness to experience tend to be more creative, to enjoy intellectual pursuits, to ponder ideas, to seek new experiences and challenges in life (McCrae & Costa, 2008). It could be one of the reasons why even women with pregnancy hypertension have better results for blood pressure than controls. We mainly hypothesized that even though they are hypertensive, they are more open to face this situation. More precisely, they might consider this period as a challenge that can be overcome, using more resources to do so. It is feasible to propose that at a physiological level the body produces a more adequate response to cardiovascular stress (Gallagher et al., 2018). Moreover, the blood pressure can be influenced since people with more openness to experience have a more adaptive profile. This is especially important in pregnant women as they are experiencing many physical and psychological changes.

As highlighted by other authors, openness to experience has a positive relation with cognitive ability and adaptive behaviors (Schaie, Willis, & Caskie, 2004). Focusing on cognitive variables, these include aspects of imagination, perception and it is related to aspects of intellectual style. These aspects are of interest in the context of pregnancy, due to the fact that it is known that many risk factors may be modified in order to change blood pressure – i.e. sedentary lifestyle, smoking, improper feeding (Gifford, 2000). In this way, women who achieve high scores in openness to experience may have more cognitive ability than others, resulting in a better repertoire of adaptive behaviors. Thus, they may have a healthier lifestyle and they can better control their blood pressure levels.

Indeed, conscientiousness including aspects related to duty, planning and organization (McCrae & Costa, 2008) was not significant. It is known that people who have more traits of conscientiousness tend to be more organized and have more adherence to norms – such as following medical prescriptions, for example. Authors found 1.4 times higher risk of death in people with lower traits of conscientiousness (Jokela et al., 2013). In the context of pregnancy hypertension, it is very important that women follow all recommendations to minimize the complications of this disorder, as well as controlling blood pressure.

Additionally, extraversion and agreeableness traits show no effects as mediators of associations between personality and blood pressure in pregnancy. Extraversion is related to enthusiasm, interest and expansiveness characteristics, whereas agreeableness is linked to altruism and kindness (McCrae & Costa, 2008). Despite the differences between these two broad domains, where extraversion might be associated with the relationship between the external world and agreeableness with interpersonal tendencies, both are important to health outcomes. A recent study found that the burnout syndrome in nursing is associated negatively with extraversion and agreeableness (Pérez-Fuentes, Molero Jurado, Martos Martínez, & Gázquez Linares, 2019). Considering that not only physical, but also mental health are important especially in pregnancy, it was expected that women presented characteristics such as sensitivity to positive emotions.

On the other hand, we found that those participants in the study who had coping focused on emotion had also higher blood pressure levels. The emotion-focused coping strategy is understood as passive coping or avoidance, effective as a short-term coping strategy (Vitaliano et al., 1987). In other words, in the long term, it can endanger mental and physical health, as it can reduce abilities to solve the problems. Especially in pregnant women, where many changes are occurring, this situation can bring about distress and compromise health. Conversely, studies found that emotion-focused coping was the most commonly employed coping strategy reported for women with postpartum depression (Azale, Fekadu, Medhin, & Hanlon, 2018) and it was associated to severe anxiety during pregnancy and after childbirth (George, Luz, De Tyche, Thilly, & Spitz, 2013).

In addition, our data showed that women who had problem-focused coping strategies did not present better blood pressure than others. However, we found that problem-focused coping has a mediation effect instead of a predictive role. Problem-focused coping strategies are associated with positive reassessment and usually help people to experience low emotional stress levels (Vitaliano et al., 1987), which could lead to better blood pressures. However, our search found only one epidemiological study from Stockholm that showed a tendency for higher hypertension rates among those scoring low on problem-focused coping (Theorell, Alfredsson, Westerholm, & Falck, 2000). The inconsistency with this study may be mainly due to the population accessed. In particular, they examined men and women from 15 to 64 years old, whereas our study just included women older than 18 years. It is important to consider that pregnancy is an exceptional period. The changes in women's lives can lead to stress, especially in women with hypertension, which can increase the use of the emotion-focused coping strategy and the experiencing of negative emotions and stress. This vicious cycle may lead to disorders such as higher blood pressure.

On the other hand, these findings are of interest because it is suggested that women can develop more appropriate coping strategies to face difficult situations under some circumstances. In other words, our results point out that higher scores in problem-focused coping strategies than in emotion during pregnancy do not influence systolic and diastolic blood pressures. This is a desirable strategy, as emotional coping has detrimental effects on blood pressure.

The present study has some limitations: first and foremost it is an incidental and not random sample. However, we have a big sample that minimizes selection bias. Data were cross-sectional so the causality among the variables cannot be inferred. Moreover our data excluded women with other comorbidities, such as a previous diagnosis of kidney disease, a history of diabetes and fetal malformation. These women may present different coping strategies and studies focused in a better understand of this situation may be of clinical relevance. Future studies should work on more complex models and other variables could be included in analysis.

## Conclusions

The implications of the present data point out that the openness to experience trait and emotion focused coping correlated with systolic and diastolic blood pressure. Moreover, detrimental effects on blood pressure were found for emotional coping. Furthermore, problem-focused coping strategies have a mediation effect, instead of a predictive role.

In light of the results of the current study, at the theoretical level, it was possible to implement the classic models to better understand the pregnant population, and especially women with hypertension. On a practical level, it is very interesting to know that we can develop coping strategies that can mediate the personality effects on blood pressures during pregnancy. Moreover, it favors not only physical health for women and their fetuses, but also their well-being and quality of life.

## Abbreviations

$\beta$  Standardized beta coefficients

Big Five The Five-Factor Model

CI Confidence interval

i.e. id est, which translates to "that is"

SD Standard deviation

SPSS Statistical Package for the Social Sciences

## Declarations

## Ethics approval and consent to participate

The Institutional Review Board of São Lucas Hospital reviewed and approved the protocol used for this study (number 1 383 399). All subjects gave written informed consent in accordance with the Declaration of Helsinki. All the procedures were adopted to satisfy the National Research Council of Brazil (Resolution 466/2012) and the Code of Ethics of the World Association.

## Consent for publication

Not applicable.

## Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

## Competing interests

The authors declare that they have no competing interests.

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## Authors' contributions

SC-d-A and BEPC conceived of the presented idea, developed the theory, performed the computations as well as the analytic calculations and took the lead in writing the manuscript. CM-T verified the analytical methods and participated in drafting the manuscript. ICFA and TI encouraged and supervised the findings of this work. All authors have read and approved the manuscript.

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## References

1. Azale, T., Fekadu, A., Medhin, G. & Hanlon, C. (2018). Coping strategies of women with postpartum depression symptoms in rural Ethiopia: a cross-sectional community study. *BMC psychiatry*, 18(41). doi:10.1186/s12888-018-1624-z
2. Baron, R. M. & 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(6), 1173-1182. doi:10.1037//0022-3514.51.6.1173
3. Bibbey, A., Carroll, D., Roseboom, T. J., Phillips, A. C. & de Rooij, S. R. (2013). Personality and physiological reactions to acute psychological stress. *International Journal of Psychophysiology*, 90(1), 28-36. doi:10.1016/j.ijpsycho.2012.10.018
4. Coutinho, T., Lamai, O. & Nerenberg, K. (2018). Hypertensive Disorders of Pregnancy and Cardiovascular Diseases: Current Knowledge and Future Directions. *Current Treatment Options in Cardiovascular Medicine*, 20(56). doi:10.1007/s11936-018-0653-8
5. Di Mattei, V. E., Carnelli, L., Bernardi, M., Jongerius, C., Brombin, C., Cugnata, F., ... Sarno, L. (2016). Identification of socio-demographic and psychological factors affecting women's propensity to breastfeed: An Italian cohort. *Frontiers in psychology*, 7(1872). doi:10.3389/fpsyg.2016.01872
6. Folkman, S., & Moskowitz, J. T. (2004). Coping: Pitfalls and promise. *Annual Review of Psychology*, 55(1), 745-774. doi:10.1146/annurev.psych.55.090902.141456
7. Gallagher, S., O'Riordan, A., McMahon, G., & Creaven, A. M. (2018). Evaluating personality as a moderator of the association between life events stress and cardiovascular reactivity to acute stress. *International Journal of Psychophysiology*, 126, 52-59. doi:10.1016/j.ijpsycho.2018.02.009
8. George, A., Luz, R. F., De Tyche, C., Thilly, N., & Spitz, E. (2013). Anxiety symptoms and coping strategies in the perinatal period. *BMC pregnancy and childbirth*, 13(233). doi:10.1186/1471-2393-13-233
9. Gifford, R. (2000). Report of the national high blood pressure education program working group on high blood pressure in pregnancy. *American Journal of Obstetrics and Gynecology*, 183, S1-S15.
10. Handelzalts, J. E., Krissi, H., Levy, S., Freund, Y., Carmiel, N., Ashwal, E., & Peled, Y. (2016). Personality, preterm labor contractions, and psychological consequences. *Archives of gynecology and obstetrics*, 293, 575-582. doi:10.1007/s00404-015-3898-4
11. Hayes, A. F. (2015). An index and test of linear moderated mediation. *Multivariate behavioral research*, 50(1), 1-22. doi:10.1080/00273171.2014.962683
12. Hayes AF. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY: Guilford Publications.
13. Hengartner, M. P., Kawohl, W., Haker, H., Rössler, W., & Ajdacic-Gross, V. (2016). Big Five personality traits may inform public health policy and preventive medicine: Evidence from a cross-sectional and a prospective longitudinal epidemiologic study in a Swiss community. *Journal of Psychosomatic Research*, 84, 44-51. doi:10.1016/j.jpsychores.2016.03.012
14. Imširagić, A. S., Begić, D., Vuković, I. S., Šimičević, L., & Javorina, T. (2014). Multivariate analysis of predictors of depression symptomatology after childbirth. *Psychiatria Danubina*, 26(3), 416-421.
15. Jalowiec, A. (1985). Construct validation of the Jalowiec coping scale [thesis]. Chicago: University of Illinois. Health Sciences Center.
16. Jokela, M., Batty, G. D., Nyberg, S. T., Virtanen, M., Nabi, H., Singh-Manoux, A., & Kivimäki, M. (2013). Personality and all-cause mortality: individual-participant meta-analysis of 3,947 deaths in 76,150 adults. *American journal of epidemiology*, 178(5), 667-675. doi:10.1093/aje/kwt170
17. Jokela, M., Pulkki-Råback, L., Elovainio, M. & Kivimäki, M. (2014). Personality traits as risk factors for stroke and coronary heart disease mortality: pooled analysis of three cohort studies. *Journal of behavioral medicine*, 37(5), 881-889. doi:10.1007/s10865-013-9548-z
18. Joshanloo, M. (2018). Fragility of happiness moderates the influence of negative predictors of subjective well-being. *Anxiety, Stress, & Coping*, 31(2), 222-227. doi: 10.1080/10615806.2017.1422094
19. McAdams, D. P., & Pals, J. L. (2006). A new Big Five: fundamental principles for an integrative science of personality. *American psychologist*, 61(3), 204-217.
20. doi: 10.1037/0003-066X.61.3.204



21. MacKinnon, D. P. (2008). *Introduction to Statistical Mediation Analysis*. New York, NY: Erlbaum.
22. MacKinnon, D. P., & Fairchild, A. J. (2009). Current directions in mediation analysis. *Current directions in psychological science*, 18(1), 16-20.
23. doi:10.1111/j.1467-8721.2009.01598.x
24. McCrae, R. R., & Costa, P. T. Jr. (2008). The Five-Factor Theory of personality. In O. P. John, R. W. Robins, & L. A. Pervin (Eds.), *Handbook of personality theory and research* (pp. 159- 181). In (New York, NY: Guilford Press. ed.).
25. Mols, F., & Denollet, J. (2010). Type D personality in the general population: a systematic review of health status, mechanisms of disease, and work-related problems. *Health and Quality of Life Outcomes*, 8(9). doi: 10.1186/1477-7525-8-9
26. Moret-Tatay, C., Lami, A., Oliveira, C., & Beneyto-Arrojo, M. (2018). The mediational role of distracting stimuli in emotional word recognition. *Psicología: Reflexão e Crítica*, 31(1). doi: 10.1186/s41155-017-0082-8
27. Navrady, L., Adams, M., Chan, S., Ritchie, S., & McIntosh, A. (2018). Genetic risk of major depressive disorder: the moderating and mediating effects of neuroticism and psychological resilience on clinical and self-reported depression. *Psychological medicine*, 48(11), 1890-1899. doi:10.1017/S0033291717003415
28. Ormstad, H., Eilertsen, G., Heir, T., & Sandvik, L. (2020). Personality traits and the risk of becoming lonely in old age: A 5-year follow-up study. *Health and Quality of Life Outcomes*, 18, (47). doi:10.1186/s12955-020-01303-5
29. Pérez-Fuentes, M., Molero Jurado, M., Martos Martínez, Á., & Gázquez Linares, J. J. (2019). Burnout and Engagement: Personality Profiles in Nursing Professionals. *Journal of clinical medicine*, 8(3), 286. doi:10.3390/jcm8030286
30. Schaie, K. W., Willis, S. L., & Caskie, G. I. (2004). The Seattle longitudinal study: Relationship between personality and cognition. *Aging Neuropsychology and Cognition*, 11(2-3), 304-324. doi:10.1080/13825580490511134
31. Theorell, T., Alfredsson, L., Westerholm, P., & Falck, B. (2000). Coping with unfair treatment at work—What is the relationship between coping and hypertension in middle-aged men and women? *Psychotherapy and psychosomatics*, 69, 86-94. doi:10.1159/000012371
32. Turiano, N. A., Pitzer, L., Armour, C., Karlamangla, A., Ryff, C. D., & Mroczek, D. K. (2011). Personality trait level and change as predictors of health outcomes: Findings from a national study of Americans (MIDUS). *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 67(1), 4-12. doi:10.1093/geronb/gbr072
33. Vitaliano, P. P., Maiuro, R. D., Russo, J., & Becker, J. (1987). Raw versus relative scores in the assessment of coping strategies. *Journal of Behavioral medicine*, 10(1), 1-18. doi:10.1007/BF00845124
34. Ó Súilleabháin, P. S., Howard, S., & Hughes, B. M. (2018). Openness to experience and adapting to change: Cardiovascular stress habituation to change in acute stress exposure. *Psychophysiology*, 55, e13023. doi:10.1111/psyp.13023

## Figures

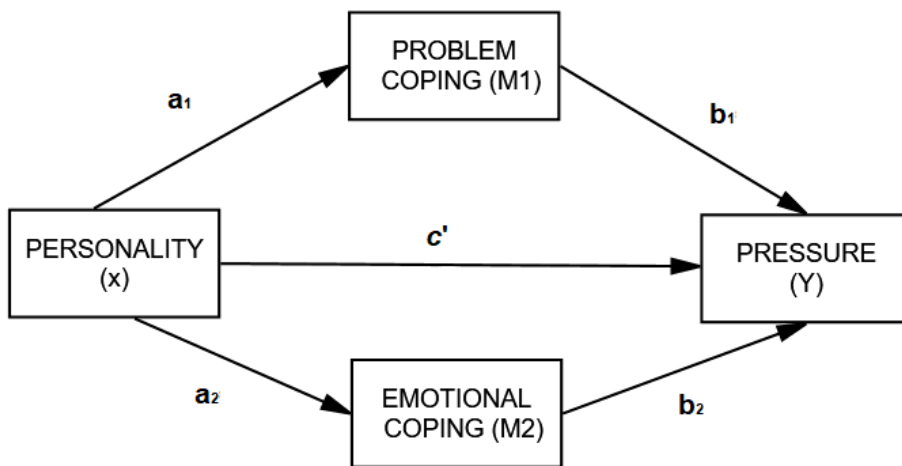


Figure 1

Mediational model to test and its underlying paths (adapted from Hayes, 2017), including two mediational variables. We try to assess whether the independent variable influences the (non-observable) mediator variable, which in turn influences the dependent variable. Therefore, this evaluation will characterize the nature of the relationship between the independent and dependent variables (MacKinnon, 2008).

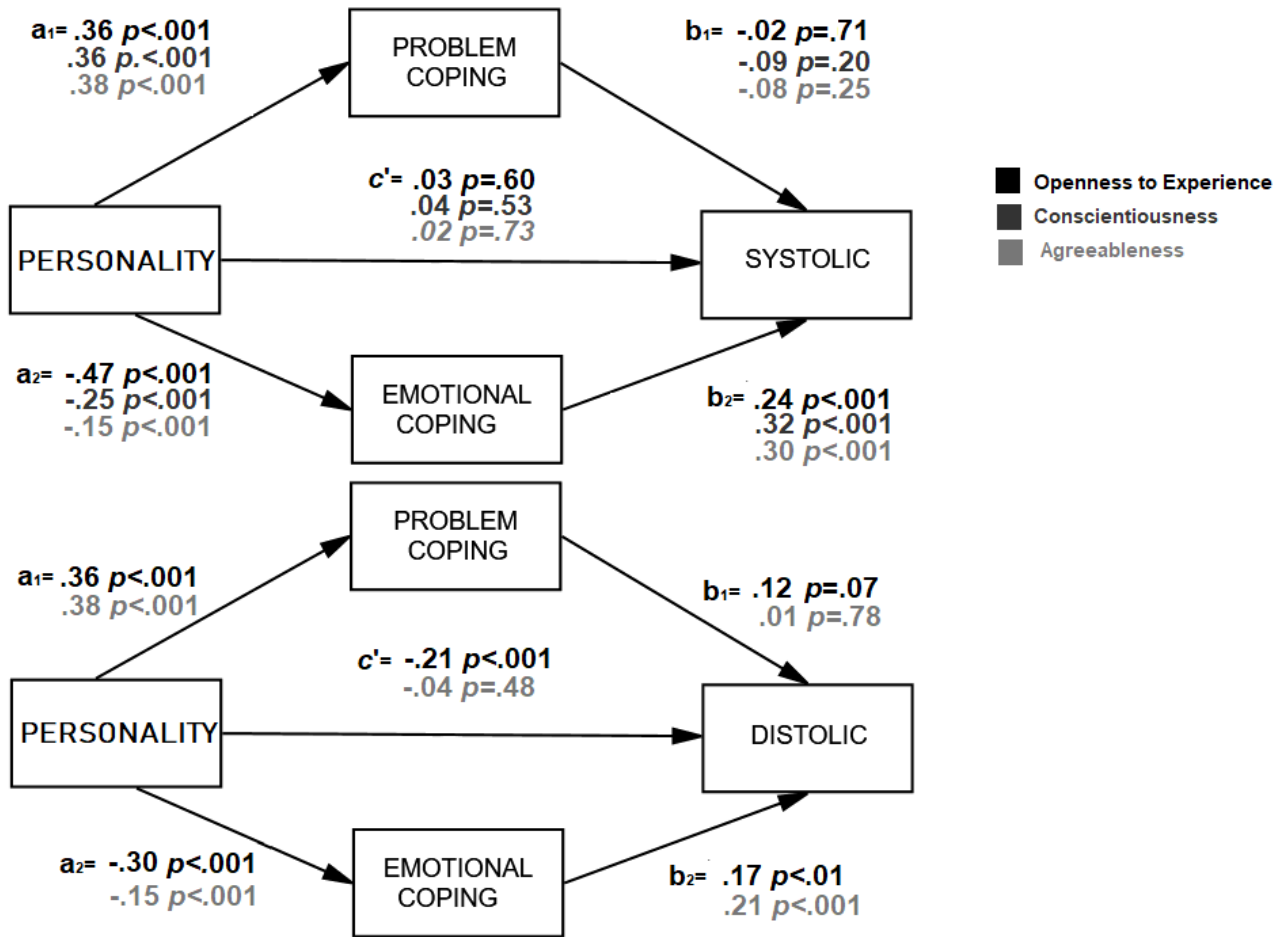


Figure 2

Estimated model, where both strategies of coping moderate the relationship between personality and blood pressure in pregnancy (\*\*= $p < .01$ ; \*= $p < .05$ ). This model is based in the first model from the Figure 1 which represents a simple statistical mediation model. In the current model, we aim to assess mediation with multiple mediators simultaneously, as coping is considered to be twofold in this model: emotional and problem focused (M2 and M1, respectively).